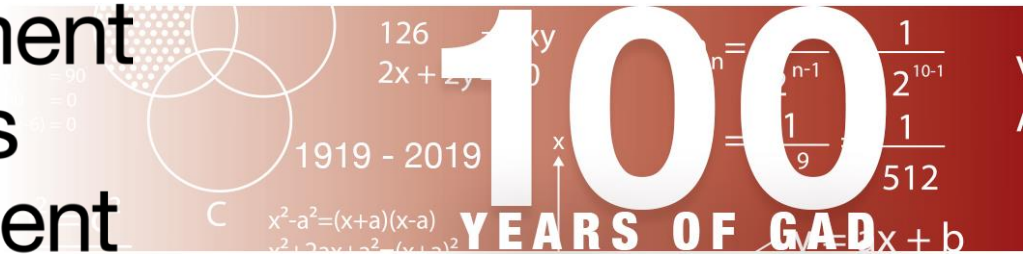
Government Actuary's Department



Police pension schemes (England & Wales)

Actuarial valuation as at 31 March 2016
Advice on assumptions

Date: 28 February 2019

Author: Dipak Hirani

Contents

1 Executive summary

This report contains our recommendations for the best estimate assumptions to be set by the Home Secretary for the 2016 valuation of the Police Pension Schemes (England & Wales) ('the Schemes').

1.1 An actuarial valuation of the Police Pension Schemes (England and Wales)[1] ('the Schemes'), is being carried out as at 31 March 2016. The Public Service Pensions (Valuations and Employer Cost Cap) Directions 2014 as amended by the (Amendment) Directions 2018 ("the Directions") require that, unless specified otherwise[2], the assumptions to be adopted for this valuation will be set by the Home Secretary, having obtained advice from the scheme actuary. Direction 19(c) requires the assumptions to be the Home Secretary's best estimates.

1.2 GAD is the appointed scheme actuary to the Schemes. This report has been commissioned by the Home Office and sets out GAD's formal advice to the Home Secretary on the actuarial assumptions to be adopted where these are not otherwise specified. The advice covers the assumptions to be set by the Home Secretary. The main advised assumptions are summarised in Table 1 with further detail in Appendix A.

1.3 This report relates to demographic assumptions ie assumptions about member behaviours. When considering appropriate assumptions, experience (both recent and longer term) generally provides the most reliable evidence when considering best estimates of future experience. Anticipated future events may also influence how assumptions are set. This advice sets out relevant analysis of recent experience and indicates which other factors have been considered in deriving recommendations of best estimate assumptions.

1.4 The previous completed actuarial valuation of the Schemes was carried out as at 31 March 2012. Many of the assumptions put forward in this report are the same as adopted for that valuation. The most significant changes are:

- Rates of pensioner mortality have been updated to reflect recent experience and to reflect changes in population mortality as reflected in the updated ONS population projections[3].
- The assumed incidence of ill-health retirement has been updated to align more closely with experience over 2012-2016.
- Normal health retirement rates for protected and tapered 1987 Scheme members reaching 30 years' service have been updated to reflect experience over 2012-2016.

[1] As provided by The Police Pensions Regulations 1987 (SI 1987/257), 2006 (SI 2006/3415) and 2015 (SI 2015/445).
[2] Certain assumptions are specified in the Directions.
[3] From the 2012 based ONS projections to the 2016 based ONS projections.

- The amount of pension assumed to be commuted for a cash lump sum at retirement has increased in respect of members with 2015 Scheme service.

1.5 The following chapters and appendices provide more detail on the advice, supporting analysis and an indication of the magnitude of financial impact of each assumption on valuation results. They also contain important background information about the context of this advice and its limitations.

1.6 The estimated financial impact of changing assumptions is shown in Table 1 below. These have been calculated in an approximate way and are intended to provide a broad indication of the impact and are not definitive.

1.7 This report was provided to the Home Secretary in draft form, and was also circulated to the Scheme's member and employer representatives, in July 2017. It has been signed alongside the formal valuation report. Since the draft version, the main changes have been to update our advice regarding the commutation assumption and to include an additional appendix regarding data uncertainty. The Home Secretary has already confirmed to GAD, having consulted with relevant stakeholders, that the actuarial assumptions to be adopted for the valuation should be those set out in this report.

Compliance and quality standards

This work has been carried out in accordance with the applicable Technical Actuarial Standards: TAS 100 and TAS 300 issued by the Financial Reporting Council (FRC). The FRC sets technical standards for actuarial work in the UK.

Table 1: Summary of recommended assumptions consistent with the 'best estimate' requirement

Assumption	Summary of recommended assumptions	Rationale for recommendation	Magnitude of financial impact of change from 2012 valuation assumptions[4]	
			Employer contributions (2019-23) – past service impact[5] (% of pay)	Employer contributions (2019-23) – past and future service impact[6] (% of pay)
Pensioner baseline mortality[7]	Aligned to standard SAPS table[8,9]			
Normal health	104% x S2NXA	A combination of the existing assumption and the 2012-2016 experience, and including the use of an 'amounts' based analysis[10].	+1.2%	+1.4%
Ill-health (current)	142% x S2NXA			
Ill-health (future)	100% x S2IXA			
Dependants	103% x S2NXA			

[4] The financial impacts have been estimated on an approximate basis using the 2012 valuation results and long term financial assumptions, and should only be used as a guide to the approximate size of the impact. Each impact is specific to the change described and a combination of assumption changes will not necessarily equate to the sum of the individual impacts.

[5] Impact on uncorrected employer contribution rate of spreading change in past service liabilities over 15 years.

[6] Total change in employer rate of spreading change past service and allowing for future service impacts.

[7] As directed by HMT, future improvements in mortality assumed to be in line with those underlying the most recent ONS population projections. The financial impact shown relates only to the change in baseline mortality.

[8] SAPS tables are published by the Actuarial Profession and are based on the experience of self-administered pension schemes from 2004 to 2011. The S2 series has separate standard tables based on experience of members retiring in normal health (S2NXA), in ill health (S2IXA) and for widows (S2DFA).

[9] Adjusted to take account of improvements in population mortality between the base year for the tables and the date the future improvements are applied from.

[10] In general 50% of the observed difference in experience since the 2012 assumptions were set has been taken into account when resetting assumptions.

Assumption	Summary of recommended assumptions	Rationale for recommendation	Magnitude of financial impact of change from 2012 valuation assumptions[4]	
			Employer contributions (2019-23) – past service impact[5] (% of pay)	Employer contributions (2019-23) – past and future service impact[6] (% of pay)
Age retirement				
1987 Scheme protected and tapered	Age and service based rates, with many retiring on reaching 30 years' service and all retiring by age 60	In light of 2012-16 experience.	+0.1%	+0.1%
1987 Scheme unprotected	No retirements before age 55. Age and service based rates, with many retiring at age 55 or 30 years' service if later. For example, for members entering at 20/25/30, 97%/90%/22.5% are assumed to retire at age 55. All assumed to retire by age 60.	1987 Scheme provides a sizeable tax-free lump sum benefit of nearly four times pay (for full service in 1987 Scheme) which can be available before age 55. However, there is a significant disincentive of leaving the 2015 scheme before age 55 (retirement age effectively increases from 60 to SPA). The minimum past service in 2015 for these members is 9 years so the potential lump sum is still a very sizeable amount even if only linked to service up to 2015 from which point accruals will be under the 2015 scheme. So it is reasonable to expect high take-up of age retirement at 55 for such members. There is, however, no relevant evidence yet.	No change in assumption.	
2006 Scheme (all members)	Around 29% retire at 55, 2% retire each year between 56 and 59 and about 62% retire at 60	Proposal makes a reasonable allowance for the take up of benefits at the earliest time at which they become available and is in line with the assumption that was adopted for the 2012 valuation. There is no relevant evidence yet. To be kept under review.	No change in assumption.	

Assumption	Summary of recommended assumptions	Rationale for recommendation	Magnitude of financial impact of change from 2012 valuation assumptions[4]	
			Employer contributions (2019-23) – past service impact[5] (% of pay)	Employer contributions (2019-23) – past and future service impact[6] (% of pay)
New entrants from 2015	25% retire at 55 and remainder retire at 60	No relevant evidence. Proposal makes a reasonable allowance for the take up of benefits at the earliest time at which they become available and is in line with the assumption that was adopted for the 2012 valuation. To be kept under review.	No change in assumption.	
Ill-health retirement				
Incidence	Sex dependent. Increasing by age: 0.01%/0.1% (M/F) at age 30, 0.2%/0.5% at age 40, 0.9%/1.5% at age 50, 1.7%/2.4% at age 59	Male rates increased to 106% of 2012 rates. Female rates increased to 114% of 2012 rates. In light of 2012-2016 experience.	No impact	+0.2%
Upper/lower tier split	50% on upper tier	No change from 2012 assumption. 2012-16 experience data not thought to be reliable.	No change in assumption.	
Withdrawal	Separate age-dependent rates assumed for males and females. Rates are typically between 0.5% and 1.5%.	No change from 2012 assumption. 2012-2016 experience is higher than 2012 assumption but events during 2012-16 suggest it is not expected to be a reliable indicator of future trends.	No change in assumption.	

Assumption	Summary of recommended assumptions	Rationale for recommendation	Magnitude of financial impact of change from 2012 valuation assumptions[4]	
			Employer contributions (2019-23) – past service impact[5] (% of pay)	Employer contributions (2019-23) – past and future service impact[6] (% of pay)
Death before retirement	Separate age-dependent assumptions for males and females. Less than 0.5% of members are assumed to die each year even at the highest ages.	No change from 2012 assumption. In light of 2012-2016 experience.	No change in assumption.	
Promotional salary scale	A single unisex service-dependent scale for all members. Steeper at shorter service (around 3%-4% pa) reducing to around 1% pa after 13 years of service.	No change from 2012 assumption. In light of 2012-2016 experience.	No change in assumption.	

Assumption	Summary of recommended assumptions	Rationale for recommendation	Magnitude of financial impact of change from 2012 valuation assumptions[4]	
			Employer contributions (2019-23) – past service impact[5] (% of pay)	Employer contributions (2019-23) – past and future service impact[6] (% of pay)
Commutation				
1987 Scheme protected	0% of pension commuted	Cost neutral commutation terms.	No change in assumption.	
2006 Scheme protected	0% of pension commuted	Commutation unavailable.	No change in assumption.	
1987 Scheme unprotected and tapered	0% of 1987 scheme and 8.75% of 2015 Scheme pension commuted	1987 Scheme offers a significantly greater lump sum for pension given up, but experience indicates members will still commute some of their 2015 Scheme pension.	No impact	-0.3%
For all other members the directed commutation assumption of 17.5% of pension applies.				
Family statistics				
Proportion married	80% (M), 75% (F) at retirement (consistent assumptions for existing pensioners)	No change from 2012 assumption. In light of 2012-2016 experience.	No change in assumptions.	
Proportion partnered	85% (M), 80% (F) at retirement (consistent assumptions for existing pensioners)	No change from 2012 assumption. In light of 2012-2016 experience.		
Age difference	Male member 3 years older than partner Female 3 years younger than partner	No change from 2012 assumption. In light of 2012-2016 experience.		
Gender of dependant	Opposite gender to member	No change (no evidence)		
Remarriage	No allowance	No change (no evidence)		

2 Introduction

This report contains our advice to the Home Secretary but will be of interest to other parties who should note the limitations.

2.1 An actuarial valuation of the Police Pension Schemes (England & Wales) ('the Schemes') is being undertaken as at 31 March 2016. The Public Service Pensions (Valuations and Employer Cost Cap) Directions 2014 as amended by the (Amendment) Directions 2018 ("the Directions") require that, unless specified otherwise[11], the actuarial assumptions to be adopted for this valuation are the responsibility of the Home Secretary, having taken advice from the scheme actuary. Direction 19(c) requires the assumptions to be the Home Secretary's best estimates.

2.2 GAD is the appointed scheme actuary to the Schemes. This report is addressed to the Home Secretary and contains our formal advice on the appropriate assumptions to be adopted for the 2016 valuation, as required by the Directions. The purpose of this advice is to enable the Home Secretary to determine the required best estimate assumptions.

2.3 The advice also has regard to HM Treasury's suggested approach[12] for setting assumptions in the absence of direct evidence.

2.4 The advice covers the main assumptions to be set by the Home Secretary. In particular, we consider the following sets of demographic assumptions in this report:

- Pensioner mortality
- Age retirement from service
- Ill-health retirement from service
- Voluntary withdrawal from service
- Death before retirement
- Promotional pay progression
- Commutation of pension for cash at retirement
- Family statistics

Appendix B includes details about the modelling approach and other calculation assumptions as required to complete the valuation, Appendix C sets out assumptions made for data uncertainties and Appendix D includes sensitivities around the choice of assumptions set by the Home Secretary.

[11] Certain assumptions are specified in the Directions.

[12] Set out in Annex A of HM Treasury's *Public service pensions: actuarial valuations and the employer cost cap mechanism* dated March 2014.

2.5 This report was provided to the Home Secretary in draft form, and was also circulated to the Police Advisory Board for England and Wales, in July 2017. It has been signed alongside the formal valuation report. Since the draft version, the main changes have been to update our advice regarding the commutation assumption and to include an additional appendix regarding data uncertainty. The Home Secretary has already confirmed to GAD, having consulted with relevant stakeholders, that the actuarial assumptions to be adopted for the valuation should be those set out in this report.

2.6 The Scheme's administrators supplied data on the experience of the scheme membership over the four-year period to 31 March 2016. We have used this data to analyse the Schemes' experience in order to develop our advice on the assumptions. Our report, *Police pension schemes (England & Wales) Actuarial Valuation at 31 March* 2016*: Report on valuation data,* also finalised today, provides information about this data and should be read in conjunction with this advice. The report includes details of the checks carried out on the data, the amendments made to the data and our residual concerns about the quality of the data. In preparing our advice, we have relied upon the general completeness and accuracy of the data provided.

2.7 When considering appropriate assumptions, experience (both recent and longer term) generally provides the most reliable evidence when considering best estimates of future experience. However, robust analysis of scheme experience will only be possible where there is both sufficient quality, and quantity, of data available. The level of reliance that can be placed on any assumptions derived from the analysis will also vary depending on these two factors. Anticipated future events may also influence how assumptions are set.

2.8 This advice sets out relevant analysis of recent experience and indicates which other factors have been considered in deriving recommendations of best estimate assumptions. The Home Secretary should consider whether there is any reason why the conclusions reached would be inappropriate. We are happy to revisit our advice to take account of any evidence relevant to expected future experience of the membership of the Schemes.

2.9 We are content for the Home Secretary to release this report to third parties, provided that:

- it is released in full
- the advice is not quoted selectively or partially
- GAD is identified as the source of the report, and
- GAD is notified of such release.

2.10 Third parties whose interests may differ from those of the Home Secretary should be encouraged to seek their own actuarial advice where appropriate. Other than to the Home Secretary, GAD has no liability to any person or third party for any act or omission taken, either in whole or in part, on the basis of this report.

3 General considerations

This chapter sets out a number of general considerations common to the setting of the different assumptions considered in this report.

3.1 The key considerations taken into account in formulating the advice in this report are explained in this section.

Directions

3.2 The advice in this report reflects the requirements of the Directions issued by HM Treasury that assumptions should be set as the Home Secretary's 'best estimates' of future experience and should contain no margin for prudence or optimism. They should be set having regard to:

- assumptions set for previous valuations
- analysis of demographic experience in the period up to the valuation date
- historic long term trends and emerging evidence which may illustrate long-term trends in the future
- relevant data from any other sources.

Different populations

3.3 The Directions require this actuarial valuation to cover both the scheme established under the Public Service Pensions Act 2013[13] ("2015 Scheme") and the previous pension schemes ("pre-2015 schemes"), being the 1987 Scheme and 2006 Scheme. Assumptions appropriate to both the 2015 scheme and the pre-2015 schemes are required for the valuation. The Directions also require assessment of benefit accrual costs over the ***implementation period***[14]. This requires assumptions about anticipated member behaviour and characteristics during 2019 - 2023 as well as assumptions about member behaviour and characteristics in the longer term.

3.4 There are currently 3 distinct groups of members.

- Those with full protection and remaining in the pre-2015 schemes to retirement. The introduction of the 2015 scheme is not expected to have any impact on this group's behaviours.
- New members to the 2015 scheme. These members' retirement behaviours are expected to be heavily influenced by the provisions of the 2015 scheme.

[13] http://www.legislation.gov.uk/ukpga/2013/25/pdfs/ukpga_20130025_en.pdf
[14] 1 April 2019 to 31 March 2023.

> Members with service in both the 2015 scheme and a pre-2015 scheme (including members with tapered protection). Over time, as the proportion of 2015 scheme service increases, the retirement behaviours are expected to become increasingly influenced by the provisions of that scheme.

3.5 Where relevant we indicate in each of the following chapters the relative importance of each set of assumptions to the groups of members identified above.

Relative importance of assumptions

3.6 The Directions require the valuation results to be estimated to the nearest 0.1% of pensionable payroll. This is a required level of accuracy for a particular calculation and based on a particular set of assumptions. Appendix D provides an indication of the sensitivity of the valuation results to the particular assumptions under consideration.

4 Pensioner Mortality

This chapter sets out our recommendation for the baseline pensioner mortality assumptions and summarises the analysis undertaken in order to inform that recommendation.

4.1 The assumptions we recommend for baseline pensioner mortality for the 2016 valuation may be summarised by reference to standard mortality tables as follows. The corresponding assumptions for the 2012 valuation are also shown.

Table 4.1: Recommended mortality assumptions

	2012 valuation		2016 valuation	
Baseline mortality	**Standard table[15]**	**Adjustment***	**Standard table[16]**	**Adjustment***
Males				
Retirements in normal health	S1NMA	103%	S2NMA	104%
Current ill-health pensioners	S1NMA	140%	S2NMA	142%
Future ill-health pensioners	S1IMA	100%	S2IMA	100%
Dependants	S1NMA	100%	S2NMA	103%
Females				
Retirements in normal health	S1NFA	103%	S2NFA	104%
Current ill-health pensioners	S1NFA	140%	S2NFA	142%
Future ill-health pensioners	S1IFA	100%	S2IFA	100%
Dependants	S1NFA	100%	S2NFA	103%

*An adjustment of 103% means that mortality rates are 3% higher than in the standard table.

4.2 As specified by HM Treasury, future improvements in mortality will be assumed to be in line with those underlying the most recent ONS population projections, ONS 2016.

[15] SAPS (S1) tables are published by the Actuarial Profession and based on the experience of self-administered pension schemes over the period 2000 to 2006. The 'S1' series has separate standard tables based on experience of members retiring in normal health (S1NXA) and in ill health (S1IXA) and for dependants (S1DFA).
[16] SAPS (S2) tables are published by the Actuarial Profession and based on the experience of self-administered pension schemes over the period 2004 to 2011. The 'S2' series includes separate standard tables based on experience of members retiring in normal health (S2NXA) and in ill health (S2IXA) and for female dependants (S2DFA). The S3 series of tables were released by CMI on 5 December 2018 and these updated mortality tables cover experience between 2009 and 2016. The final tables are unchanged from the working paper issued during 2018, from which GAD concluded that moving to the S3 tables would have no material impact on the valuation results as a whole. It therefore remains appropriate to use the S2 tables for the current valuation.

Comparison of expected pensioner longevity

4.3 The table below gives a comparison of the resulting life expectancies[17] (allowing for future improvements) assumed for the 2012 valuation and recommended for the 2016 valuation. The life expectancies shown under each column are calculated using the following assumptions:

- The mortality assumption adopted for the 2012 valuation allowing for ONS 2012 future mortality improvements.
- The mortality assumption adopted for the 2012 valuation changed from a 'lives' to 'amounts' basis (see paragraphs 4.8 to 4.13).
- As previous column, but with life expectancies calculated from the year 2016, rather than from 2012.
- The proposed mortality assumption for the 2016 valuation allowing for ONS 2016 future mortality improvements (on an 'amounts' basis).

Table 4.2: Comparison of life expectancies (years) at the valuation date

Base table:	**2012 assumption (lives)**	**2012 assumption (amounts[18])**	**2012 assumption (amounts[17])**	**2016 assumption (amounts)**
Future mortality improvements:	**ONS 2012**	**ONS 2012**	**ONS 2012**	**ONS 2016**
Effective year for life expectancies:	**2012**	**2012**	**2016**	**2016**
Current normal health pensioners				
Male aged 60	27.8	28.2	28.6	27.3
Male aged 65	22.9	23.2	23.2	22.4
Female aged 60	30.3	30.7	31.1	29.0
Female aged 65	25.4	25.7	26.2	24.1
Future normal health pensioners – current age 45				
Male life expectancy from age 60	29.5	29.9	30.3	28.8
Male life expectancy from age 65	25.1	25.4	25.9	24.3
Female life expectancy from age 60	32.0	32.4	32.8	30.4
Female life expectancy from age 65	27.5	27.9	28.3	25.9

[17] Cohort life expectancies based on the ages shown as at the valuation date, ie allowing for future mortality improvement.

[18] At the 2012 valuation it was not possible to carry out an 'amounts' based analysis but sufficient data was available at the 2016 valuation to carry out an 'amounts' based analysis on the 2012-16 data and to show the 2012 valuation assumption on an 'amounts' rather than 'lives' basis, assuming the relationship between the two had been the same in 2012 as in 2016. These columns show the impact of changing the 2012 valuation assumption to an 'amounts' basis. See paragraphs 4.8 to 4.13 for further details.

Use of the assumption

4.4 Pensioner mortality is a key valuation assumption and is a measure of how long members retiring in normal or ill-health, or their dependants, expect to live and receive benefits.

Analysis and setting the assumption

4.5 We have analysed the actual pensioner mortality experience over the four-year period to 31 March 2016 for male normal-health retirements, male ill-health retirements and female dependants. There is insufficient data to carry out a credible analysis for female normal-health retirements, female ill-health retirements and male dependants. For these groups we have proposed use of the same adjustment to standard mortality tables as that applying to members of the opposite sex. We do not expect the incidence of ill-health retirement mortality to significantly differ by scheme and therefore the ill-health analysis is not separated by scheme. This is consistent with the approach adopted at the 2012 valuation.

4.6 For those groups where a credible analysis is possible, we have analysed the actual pensioner mortality experience over the four-year period to 31 March 2016 on an 'amounts' basis. To derive an assumption on an amounts basis we have compared the actual amounts of pension ceasing on deaths with those expected had the members' experience been in line with the mortality rates in the relevant current SAPS tables ("S2 Tables"). The recommended assumption of baseline pensioner mortality is expressed by reference to suitable adjustments to the rates in the relevant S2 table ("the base table"). The analysis is carried out using ONS 2014 projections, being the set of projections available at the time that the analysis was carried out. Previous analysis carried out by GAD suggested that the impact of using ONS 2014 or 2016 projections for mortality analysis would be minimal.

4.7 The four year period ending on the valuation date showed significant volatility in mortality experience year on year. This is illustrated in Table 4.3 (for normal health males only) below. The figures shown are the ratios of actual to expected death rates with expected rates based on the 2012 valuation assumptions, adjusted as appropriate for each period analysed. This analysis suggests that differing conclusions may have been drawn had the valuation date and inter-valuation period fallen differently. As assumptions are intended to reflect long term expectations it is reasonable to seek to smooth out the impact of these short term effects. Our recommendation is that the short term effects should be smoothed out by averaging between the 2012 assumption and the 2012-16 experience. This averaging will be weighted to reflect the amount of credible data in the 2012-16 experience relative to the amount of credible data underlying the 2012 assumption.

Table 4.3 – Variation in rates of death by scheme year

Year	Normal health males (Actual / Expected based on 2012 assumption*)
2012-13	100.2%
2013-14	91.8%
2014-15	95.3%
2015-16	89.9%
Overall	94.1%

*2012 baseline with ONS-2014 improvements

'Amounts' analysis vs 'lives' analysis

4.8 Provided adequate data is available, mortality can be analysed on either a 'lives' basis or an 'amounts' basis:

- A lives basis gives an equal weighting to every member of the population being analysed.
- An amounts basis weights the experience by the size of each member's pension (with the longevity of those with larger pensions given more of a weighting).

4.9 There is much evidence[19] to demonstrate that the size of pension is positively correlated with longevity, ie on average those with bigger pensions live longer. For a population with significant variation in the characteristics of the membership and in the amounts of pension being paid, an amounts mortality analysis is generally expected to show lower rates of mortality than a corresponding lives analysis.

4.10 Where possible it is usually preferable to use an amounts analysis rather than a lives analysis to set the mortality assumption for an actuarial valuation as in an amounts analysis the weighting given to different members' mortality experience more closely reflects the relative size of their financial liabilities to the pension scheme.

4.11 At the 2012 valuation it was not possible to complete an amounts analysis as data on pension amounts at death was not available. Therefore, a lives analysis was done and this was used to set the assumptions which were adopted for the valuation. GAD's *Advice on assumptions* report dated 11 December 2014 included the following comment:

[19] For example see CMI self-administered Pension Schemes Mortality Committee, Working Paper 65: *Analysis of the mortality experience of pensioners of self-administered pension schemes for the period 2004 to 2011, April 2013.*

…we have carried out our analysis on a 'lives' basis. We consider this to be a suitable method for the Schemes, as the underlying population in the Schemes is largely homogeneous, and so pension amounts are less widely spread than would be the case in a more diverse scheme. However, if the amounts data were available it is likely that analysis would lead to different mortality rates.

4.12 For the 2016 valuation it has been possible to do an amounts analysis and a lives analysis. For normal health males, the amounts analysis results in mortality rates that are 4% lower than the lives analysis. This 4% difference is consistent across each year of the 2012-16 period that has been analysed. As discussed in paragraph 4.7, we propose to set the 2016 assumptions by averaging between the observed 2012-16 experience and the 2012 assumption. In doing this we have subtracted 4% from the 2012 assumption for normal health males to give what we estimate the 2012 assumption would have been had we been able to do an amounts analysis (ie we have assumed that the 2012 assumption was 99% of the S1NMA table rather than the 103% of S1NMA which was actually used in the valuation).

4.13 For ill-health males and dependant females, it is not as clear what impact an amounts analysis would have had on the assumptions that were adopted for the 2012 valuation. For ill-health pensioners the impact of changes in eligibility for ill-health retirement are likely to distort the differences between amounts and lives analyses over time. For dependants, the size of a dependant's pension will not always be a good indicator of overall income meaning that the differences between amounts and lives analyses are likely to be more variable over time. Therefore, we have assumed that the mortality assumptions for ill-health males and dependant females at the 2012 valuation would have been unchanged if it had been possible to complete an amounts analysis.

Results of analysis

4.14 Table 4.4 sets out the number of pensioner deaths and amount of pension ceasing due to deaths over the inter-valuation period. These figures exclude:

- normal health and ill health deaths from 16 police forces (covering around 27% of all pensioners)
- dependants deaths from 25 police forces (covering around 42% of all dependants)

where the data provided about deaths did not appear credible. Figures are shown separately for males and females retiring in normal or ill-health and for dependants. In each case these are compared with the expected figures from the 2012 valuation assumption (with ONS-2014 improvements) and with the unadjusted 2016 base table.

Table 4.4: Pensioner mortality experience 2012-16

Category	Number of deaths included in analysis	Pension amount ceasing due to deaths £'000s (pa)	A/E* relative to the 2012 valuation assumption†	A/E* relative to the S2 Base Tables†
Normal Health:				
Males	4,254	72,464	94.1%	102.9%
Females	86	Dataset too small for credible analysis		
Ill Health:				
Males	1,520	22,222	89.0%	132.3%
Females	88	Dataset too small for credible analysis		
Dependants:				
Males	10	Dataset too small for credible analysis		
Females	2,523	17,788	108.9%	109.2%

*A/E is actual divided by expected
† With ONS-2014 improvements in each case

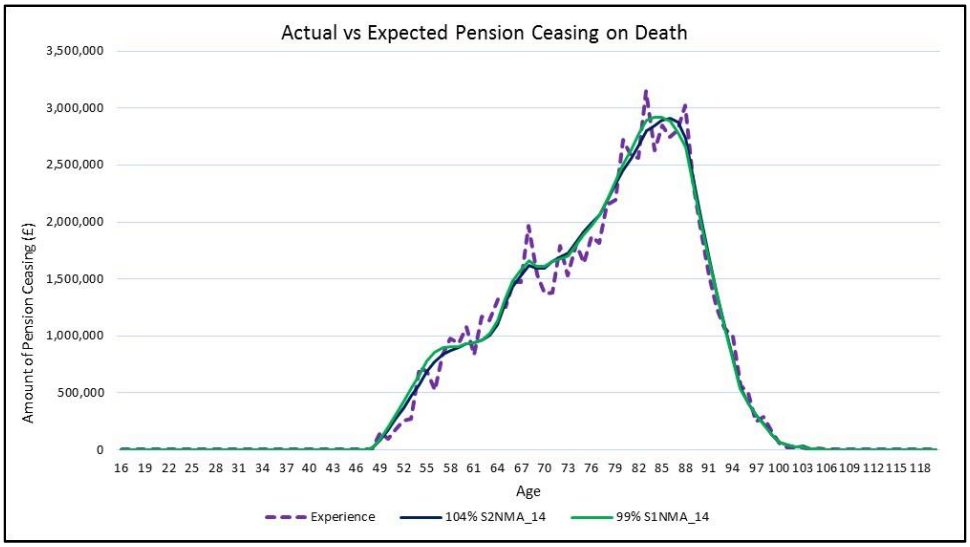
Results of Analysis: Normal Health Pensioner Mortality

4.15 Graph 4.1 below shows, by age, a comparison of:

- the actual mortality experience (amount of pension ceasing) for male normal health pensioners over the four year period (purple dashed line)
- the expected amount of pension ceasing based on the 2012 valuation assumption[20] after adjusting to reflect the expected assumption if it had been possible to complete an 'amounts' analysis in 2012 – see paragraph 4.12 (green line)
- the 'best fit' of experience to the most appropriate S2 base table[21] (blue line).

[20] With ONS-2014 improvements.
[21] With ONS-2014 improvements.

Graph 4.1: Male normal health pensioner mortality experience 2012-16



Comments on analysis

4.16 The experience suggests slightly lighter mortality overall than expected based on the 2012 assumption (after adjusting the 2012 assumption as described in paragraph 4.12). The recommended assumption has been derived by taking an average of the 2012 assumption and the 2012-16 experience (this is shown by the blue line in Graph 4.1), with a 50:50 weighting of the 2012 assumption and 2012-16 experience.

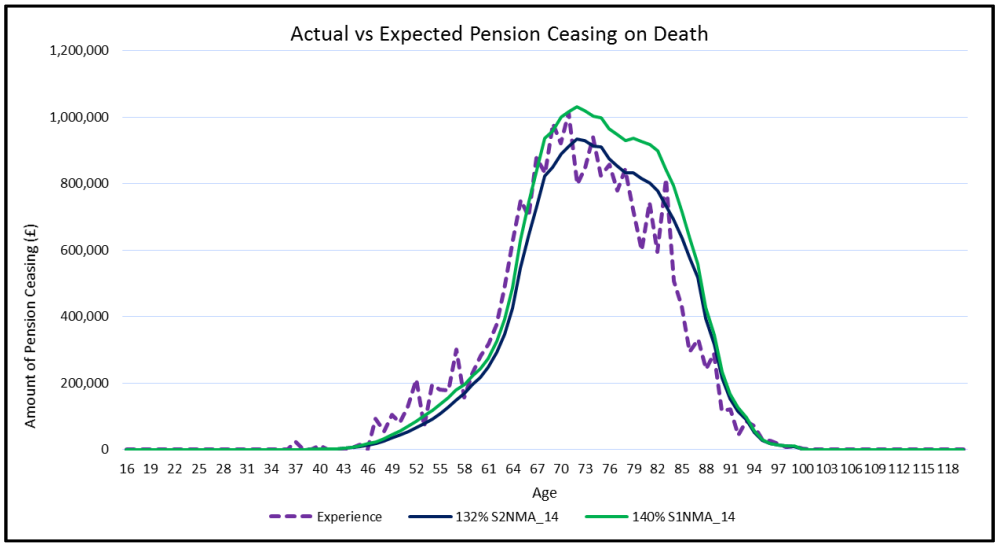
Results of Analysis: Ill-Health Pensioner Mortality

4.17 Graph 4.2 below shows, by age, a comparison of:

- the actual mortality experience (amount of pension ceasing) for male ill-health pensioners over the four year period (purple dashed line)
- the expected amount of pension ceasing based on the 2012 valuation assumption[22] (green line)
- the 'best fit' of experience to the most appropriate S2 base table[23] [24](blue line).

[22] With ONS-2014 improvements.
[23] With ONS-2014 improvements.
[24] A comparison against the male ill-health table (S2IMA) was carried out but the male normal life table (S2NMA) proved a better comparator to the experience.

Graph 4.2: Male ill-health pensioner mortality experience 2012-16



Comments on ill-health analysis

4.18 The experience suggests lighter mortality overall for current ill-health pensioners than expected based on the 2012 assumption. The recommended assumption for current ill-health pensioners has been derived by taking an average of the 2012 assumption and the 2012-16 experience (ie the assumption is between the green and purple lines) with a 100:75 weighting of the 2012 assumption and 2012-16 experience.

4.19 For future ill-health retirements we recommend a different assumption compared to that for current ill-health pensioners to reflect an expectation that the mortality experience of future ill-health pensioners will be different from that of current ill-health pensioners. We do not hold sufficient data on those retiring under the current ill-health arrangements to carry out a credible mortality analysis; therefore a pragmatic approach is needed to setting the assumption for the mortality of future ill-health pensioners. The approach we recommend is to assume mortality is in line with the S2IA tables (which are based on the ill-health experience of certain private sector pension schemes). This may be justified on the grounds that the ill-health criteria in public and private sector pension schemes are now likely to be broadly similar, with ill-health mortality being driven primarily by the illness rather than the type of work undertaken. The relatively low level of ill-health retirement means that the choice of assumption is not particularly material.

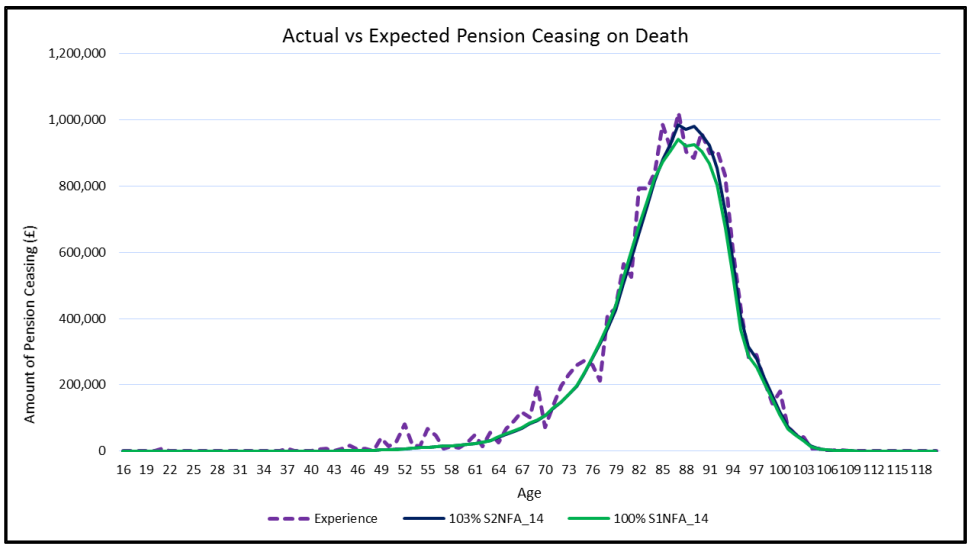
Results of Analysis: Dependant Pensioner Mortality

4.20 Graph 4.3 below shows, by age, a comparison of:

- the actual mortality experience (amount of pension ceasing) for female dependants over the four year period (purple dashed line)

- the expected amount of pension ceasing based on the 2012 valuation assumption[25] (green line)
- the 'best fit' of experience to the most appropriate S2 base table[26] [27] (blue line).

Graph 4.3: Female Dependants mortality experience 2012-16



Comments on Dependants analysis

4.21 The experience suggests slightly heavier mortality than expected based on the 2012 assumption. The recommended assumption has been derived by taking an average of the 2012 assumption and the 2012-16 experience (ie the assumption is between the green and purple lines), with a 100:50 weighting of the 2012 assumption and 2012-16 experience.

[25] With ONS-2014 improvements.
[26] With ONS-2014 improvements.
[27] A comparison against the female dependant table (S2DFA) was carried out but the female normal life table (S2NFA) proved a slightly better comparator to the experience.

5 Age retirement from service

This chapter sets out our recommendation for the assumed patterns of retirement on grounds other than ill-health, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

5.1 We recommend that rates of age retirement are set separately for members who continued in the 1987 scheme after April 2015, for new entrants from 1 April 2015 and for those who will have service in the pre-2015 schemes and the 2015 scheme. Sample age retirement rates are provided in Appendix A. This approach to setting assumptions was adopted for the previous valuation. There is not yet any evidence on which to reconsider this approach.

Members remaining in the 1987 scheme after April 2015 (including those in tapering)

5.2 For this category, we recommend that for those reaching 30 years' service an average between the 2012 assumption and the 2012-16 experience is adopted for the 2016 valuation with rates at all other service and age combinations maintaining the 2012 assumption. Both age and service are taken into account in the retirement rates. Many members are assumed to retire on reaching 30 years' service and all are assumed to retire by age 60.

New entrants to the 2015 scheme

5.3 Our recommended assumption is:

- 25% of members reaching age 55 are assumed to retire immediately; and
- all remaining members will retire at age 60.

5.4 The assumption is intended to make a reasonable allowance for the take-up of benefits at the earliest time at which they become available (with reduction for early payment) and is the same assumption that was adopted for the 2012 valuation.

5.5 In the 2015 scheme, an actuarial uplift will be applied to the pension payable on retirement after age 60. Therefore, no allowance is required for late retirement after age 60.

Unprotected members with service in the 1987 and 2015 schemes

5.6 For 1987 Scheme members that joined the scheme before age 30, we recommend assuming no members will retire before age 55. Instead, we recommend assuming that most members will retire at the later of age 55 and reaching 30 years of service.

5.7 For 1987 Scheme members that joined the scheme after age 30 (and so cannot retire before age 55), we recommend maintaining the 2012 assumption which merges between the patterns of retirement for members remaining in the existing scheme and those applying to new entrants to the 2015 scheme as adopted for the 2012 valuation.

Members remaining in the 2006 Scheme or with service in both the 2006 and 2015 schemes

5.8 We recommend merging between the assumed pattern of retirement for 2006 Scheme members in the 2012 valuation and that applying to new entrants to the 2015 scheme. Given the small group, we recommend that all members with 2006 Scheme service are assumed to retire under a single set of assumptions based on their average characteristics.

Previous valuation assumptions

5.9 The proposed assumptions are identical in nature and effect to those which were adopted for the 2012 valuation for all categories of members except members remaining in the 1987 Scheme after April 2015 (including those in tapering) where the recommended assumption is the average of the 2012 assumption and 2012-16 experience.

Use of the assumption

5.10 Age retirement rates specify the rate at which members are assumed to retire on grounds other than ill-health.

5.11 There are no provisions for early retirement from active service in the 1987 and 2006 schemes. However, in the 2015 Scheme, members will be able to retire from active service from age 55, with an actuarial reduction applied to the pension payable if retirement occurs before age 60. The actuarial reduction is set to give the early retirement pension the same value as deferred benefits payable following withdrawal at the same age (but with reference to payment age 60 rather than the usual deferred payment age of SPA). As the deferred benefits are expected to be less valuable than the benefits payable had the member stayed in service and retired at 60, early retirement will represent a saving to the Scheme.

5.12 In the 1987 and 2006 schemes the pension payable on late retirement is not subject to actuarial adjustment. This means that late retirements from the 1987 or 2006 Scheme typically reduce the costs to the Scheme (ie the value of the benefit payable to a member is typically lower). The rates of retirement of members of the 1987 and 2006 schemes are therefore financially significant assumptions. In the 2015 Scheme, an actuarial uplift will be applied to the pension payable on retirement after age 60. No allowance for late retirement of 2015 Scheme members is therefore proposed.

Analysis and setting the assumption

5.13 For the 2012 valuation we concluded a reasonable process for setting age retirement rates was to recommend:

- assumptions for the group expecting to receive benefits wholly or mainly from the existing schemes (ie those with full protection or continuing in the existing schemes after 31 March 2015 under the taper arrangements) by reference to the recent retirement experience in the Scheme.
- assumptions for new entrants to the 2015 Scheme and those expecting to receive benefits mainly from the 2015 Scheme (ie those transferring to the new scheme on 1 April 2015) by considering any relevant evidence. Since the majority of the available experience continues to relate to retirements from the 1987 Scheme, the actual scheme experience is not directly relevant for this purpose. As such, we recommend that rates for this group of members is in line with the assumptions adopted for the 2012 valuation.

5.14 For the purposes of considering the assumptions appropriate for the first group of members above (ie those continuing in the 1987 Scheme after 31 March 2015) we have compared the actual rates of age retirements over the four-year period to the valuation date to the expected rates based on the corresponding 2012 valuation assumptions.

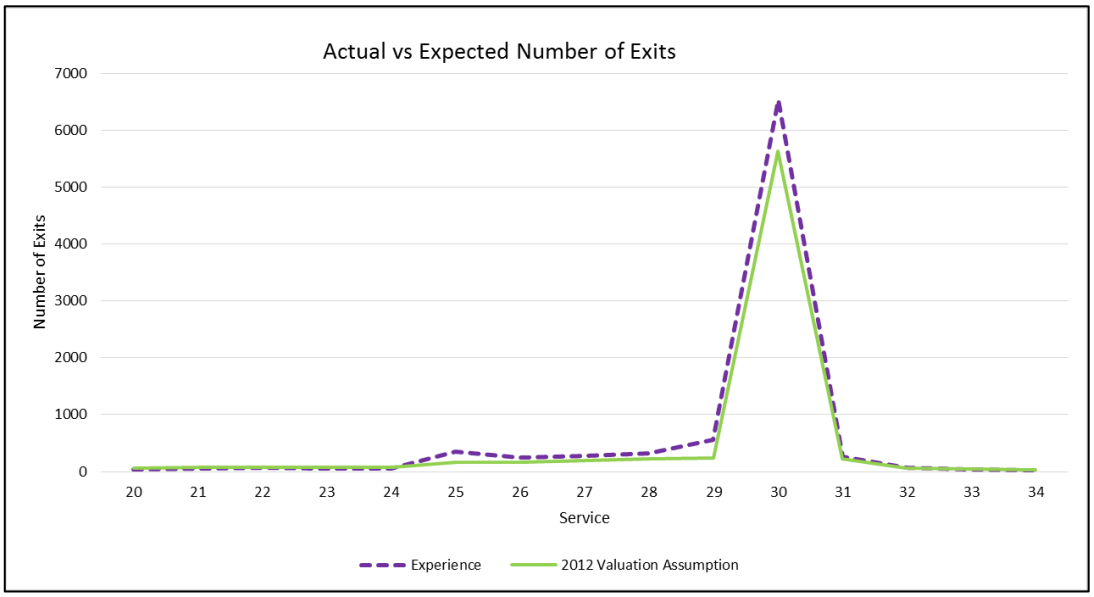
5.15 There is insufficient data to undertake any analysis of retirements from the 2015 scheme.

5.16 After excluding from our analysis 22 police forces (covering 35% of active scheme members) where the data did not appear reliable, there were around 9,540 age retirements over the four-year period to 31 March 2016 compared to an expected 7,730 retirements based on the 2012 assumptions.

5.17 We have compared the actual rate of age retirements to the expected rate from the 2012 actuarial valuation and the recommended assumption has been based on this comparison.

Results of analysis: Members remaining in the 1987 scheme after April 2015 (including those in tapering)

Graph 5.1: Actual retirements vs expected based on the 2012 assumption



Comments on results of age at retirement analysis

5.18 The graph above shows reasonably good alignment of experience against the 2012 assumption. At 30 years' service, around 12% more members retired than expected over the 4-year period. For this reason we recommend that the assumed rate of age retirement at the 30 year service point is increased slightly for the purposes of the 2016 valuation. Allowing for some expected fluctuation in experience over periods of time we recommend 50% of the difference in experience is reflected in the revised assumptions.

6 Ill-health retirement from service

This chapter sets out our recommendation for the assumed rates of retirement on grounds of ill-health, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

6.1 We recommend that a single set of assumptions (separate for men and women) is used to allow for the incidence of ill-health retirement, ie applying both to those members who remain in the pre-2015 schemes and members of the new scheme. Assumed rates of ill-health increase with age up to around 2% for men and women at the highest ages. Sample rates are provided in Appendix A.

6.2 We also recommend assuming that 50% of members retiring from the 2006 Scheme and the 2015 scheme on ill-health grounds will receive the upper-tier benefit and the remaining 50% will receive the lower-tier benefit.

Previous valuation assumptions

6.3 The proposed 2016 assumptions for the incidence of ill-health retirement are slightly higher than the rates adopted for the previous valuation. They are 106% and 114% for men and women respectively of the 2012 assumption.

6.4 The assumed proportion of members eligible for upper-tier[28] benefits is unchanged from that adopted for the previous valuation.

Use of the assumptions

6.5 Ill-health retirement rates specify the rate at which members are assumed to retire on grounds of ill-health. The assumed eligibility for upper or lower tier awards specifies the benefits which will be provided in the 2006 Scheme and 2015 scheme. The ill-health assumptions have a low impact on the overall results. The rates of mortality experienced after ill-health retirement are also relevant to the valuation calculations. Post retirement mortality is addressed in Chapter 4.

Analysis and setting the assumption

Ill health incidence

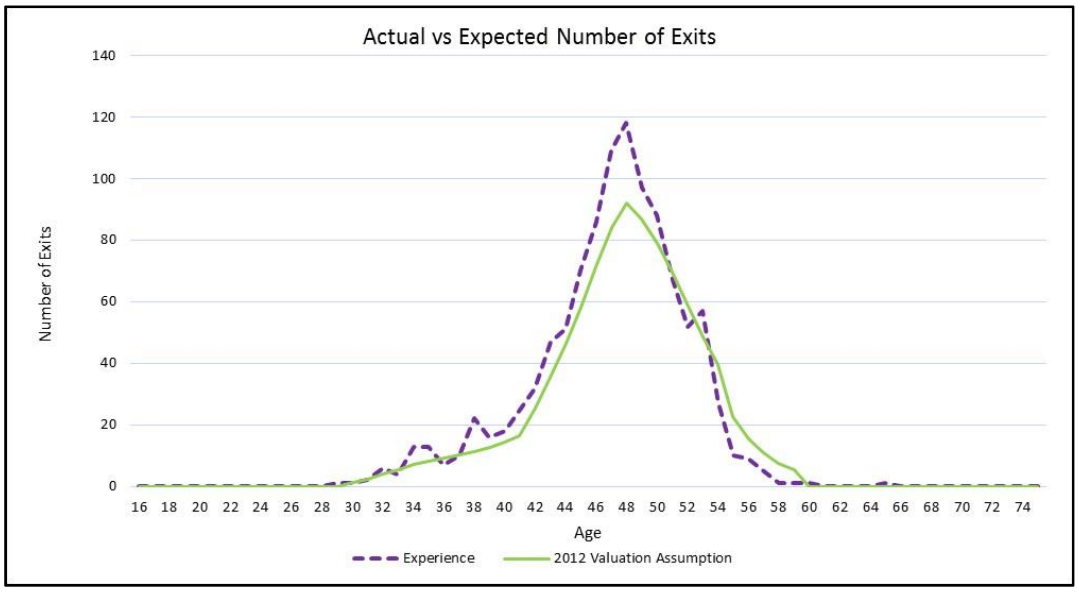
6.6 After excluding from our analysis 17 police forces (covering 24% of active scheme members) where the data did not appear to be reliable, there were around 1,730 ill-health retirements over the four-year period to 31 March 2016 compared to an expected 1,480 retirements based on the 2012 assumptions.

[28] A lower tier award provides for immediate payment of accrued benefits with no actuarial reduction, regardless of age. An upper tier award provides for enhancement of accrued benefits.

6.7 We have compared the actual rate of ill-health retirements (by gender and age of retirement) to the expected rate from the 2012 actuarial valuation and the recommended assumption has been based on this comparison.

Results of analysis

Graph 6.1: Actual male retirements vs expected based on 2012 assumption



Graph 6.2: Actual female retirements vs expected based on 2012 assumption

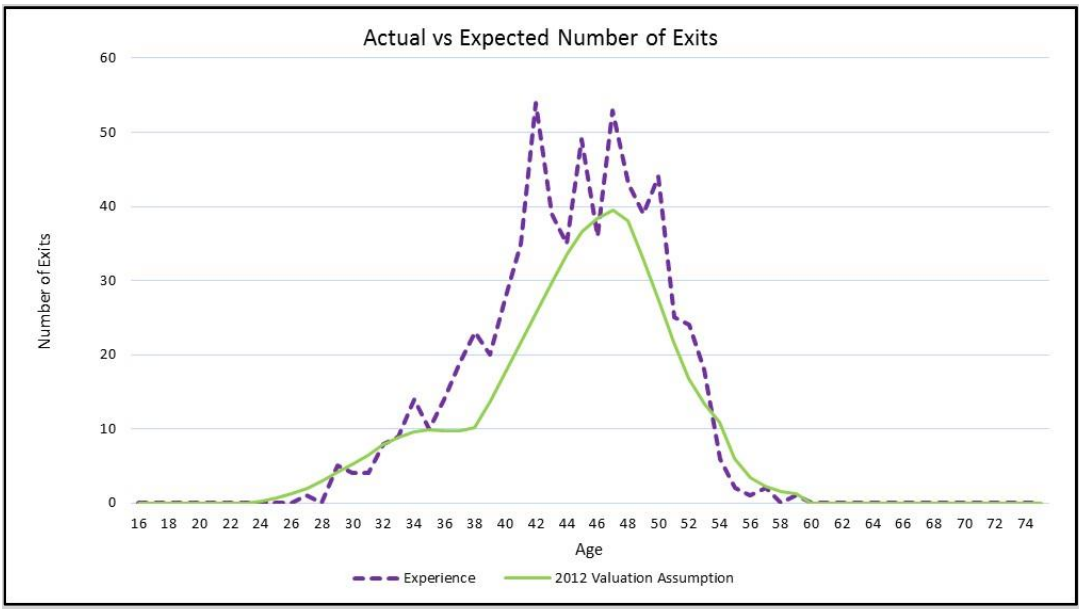


Table 6.1: Actual retirements vs expected based on 2012 assumption

	Males		Females	
	Ill-health retirements	**Actual / Expected**	**Ill-health retirements**	**Actual / Expected**
2012-13	272	113%	168	137%
2013-14	267	111%	159	124%
2014-15	265	110%	192	144%
2015-16	263	110%	146	107%
Total	1,067	111%	665	128%

Comments on ill-health retirement analysis

6.8 The graphs above show reasonably good alignment of experience against assumptions for both men and women. Overall around 11% more men and 28% more women than expected retired on ill-health grounds over the 4-year period. For this reason we recommend that the assumed rates of ill-health retirement for men and women are increased slightly for the purposes of the 2016 valuation. Allowing for some expected fluctuation in experience over periods of time we recommend 50% of the difference in experience is reflected in the revised assumptions ie the rates are set equal to 106% for men and 114% for women of those adopted for the 2012 valuation.

Split between ill-health tiers

6.9 There is still relatively little data about the two tier ill-health retirements on which to base an assumption for the percentage qualifying for upper tier benefits. The evidence suggests that almost all retirements are on upper tier benefits, however, further analysis of the data shows that for many forces all of their ill health retirements were recorded as upper tier. It is possible that retirements have been recorded as upper tier (perhaps by default) regardless of the actual tier of benefits the member received. We do not expect this assumption to have a significant impact on the valuation results.

6.10 Our proposal is to maintain the existing assumption (that 50% of retirements are upper tier) on the basis that the data may not be reliable. However, we note that this assumption is of low materiality to the overall valuation results.

7 Voluntary withdrawal from service

This chapter sets out our recommendation for the assumed rates of withdrawal from active service, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

7.1 We recommend that a single set of rates of withdrawal (separate for men and women) is used for the purposes of the valuation, applying equally to those members who remain in the existing scheme and those who join the new scheme. The recommended rates decrease with age and are typically between 0.5% and 1.5% a year. The same rates apply regardless of the length of the member's service, except that no withdrawal will be assumed for members entitled to immediate benefits. Sample rates are provided in Appendix A.

Previous valuation assumptions

7.2 The proposed 2016 assumptions are the same as the rates adopted for the previous valuation.

Use of the assumption

7.3 Withdrawal rates specify the rate at which members are assumed to leave voluntarily before retirement, becoming entitled to either deferred benefits or, for those with less than two years' service, a refund of contributions.

7.4 There is insufficient evidence to indicate the level of members re-joining the Schemes after leaving. For the avoidance of doubt, all members assumed to withdraw are assumed not to re-join.

7.5 The assumed level of withdrawals is relatively low and hence the assumption is not particularly material to the overall valuation results.

Analysis and setting the assumption

7.6 We have analysed the pattern of withdrawals from active membership over the four-year period to 31 March 2016. After excluding data from 17 forces (covering around 24% of active members) which was not thought to be reliable, there were a total of 8,068 withdrawals over the period. This was significantly higher than the 3,870 withdrawals expected under the 2012 assumptions.

7.7 We have also analysed withdrawals for the subset of the membership with 2 or more years of service. The rates of withdrawal are broadly similar to those observed for the whole membership. This suggests that the higher than expected withdrawal rates are not due to members being auto-enrolled and then immediately withdrawing.

7.8 There are a number of reasons why events in the 2012-16 period may mean that levels of withdrawal during the period are atypical and would not be expected to be repeated in future. These reasons include:

- The reduction in police numbers from around 135,000 to 120,000 over the four year period to 31 March 2016.[29]
- The increases to member contributions over the period 2012-15.
- The introduction of the 2015 scheme on 1 April 2015.
- Continued public sector pay restraint.
- Changes to pension taxation.

7.9 All of the events listed in the paragraph above could reasonably have led to higher withdrawals than expected. Given that withdrawal experience in the 2012-16 period is not expected to be a good indication of future rates of withdrawal, our proposal is to maintain the existing assumption.

Results of analysis

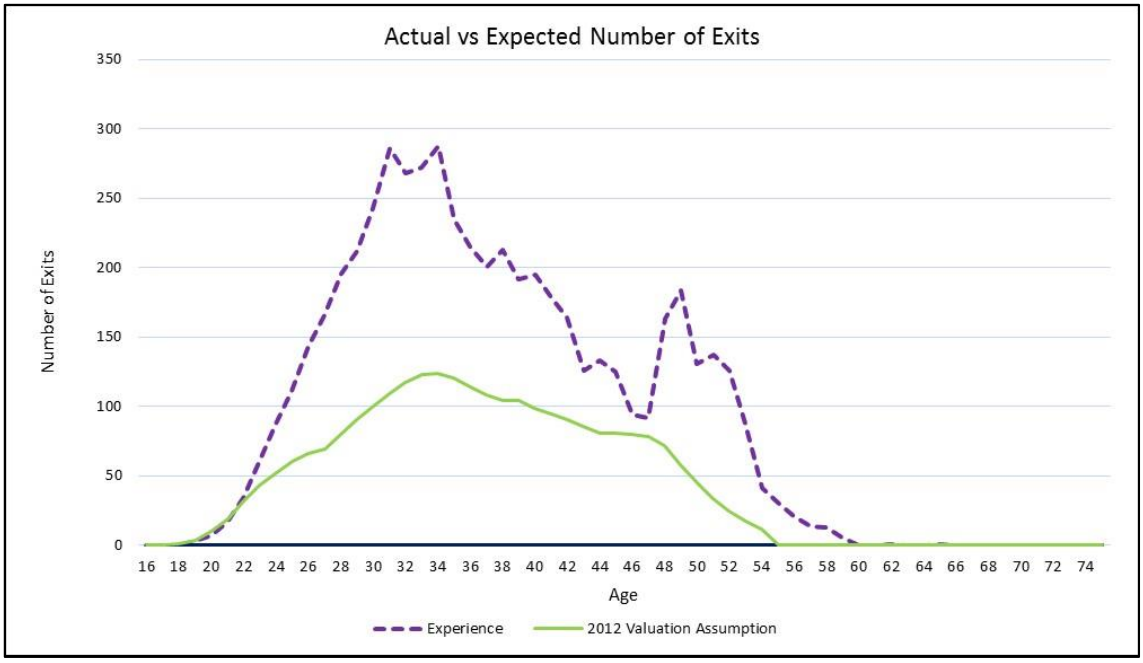
7.10 The analysis compares the actual number of voluntary withdrawals for men and women by age compared to the expected number from the 2012 actuarial valuation.

Table 7.1: Actual withdrawals in 2012-16 vs expected – Males

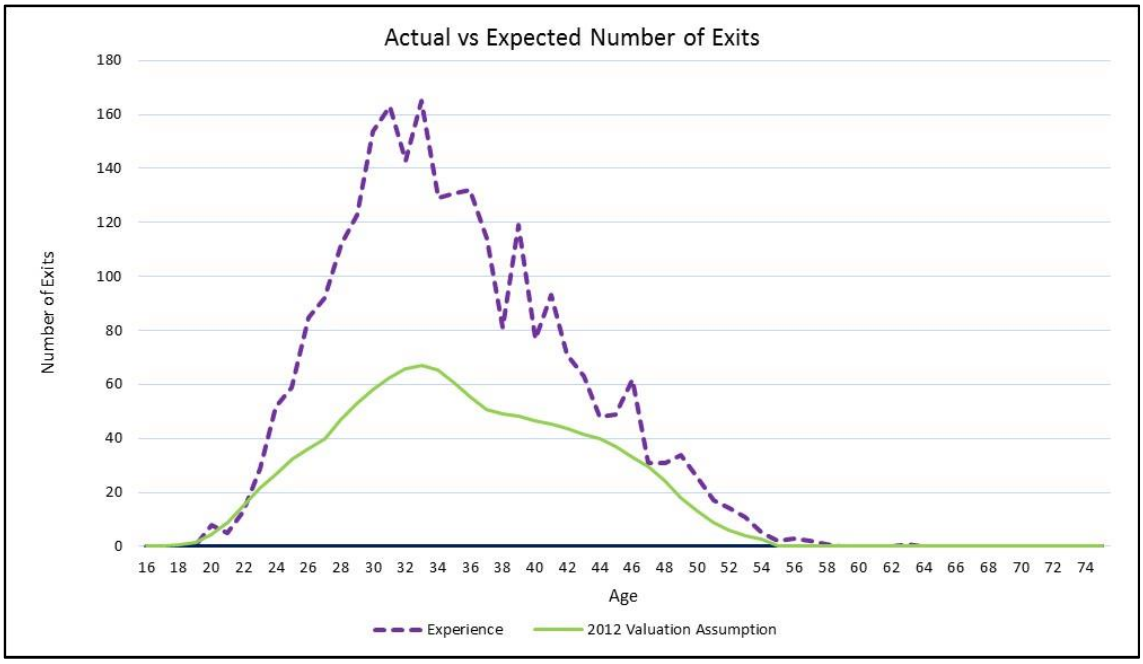
	Actual withdrawals	Expected withdrawals (under 2012 valuation assumption)	Actual / Expected
Males	5,518	2,606	212%
Females	2,550	1,264	202%
Total	8,068	3,870	208%

[29] https://www.gov.uk/government/collections/police-workforce-england-and-wales

Graph 7.1: Actual withdrawals in 2012-16 vs expected – Males



Graph 7.2: Actual withdrawals in 2012-16 vs expected – Females



7.11 Charts 7.1 and 7.2 and Table 7.1 show that the actual numbers of withdrawals has been significantly higher than expected under the 2012 assumptions. We have already discussed above some possible reasons why withdrawals have been so high over 2012-16 and therefore why we do not propose to use the experience to set the assumption for rates of future withdrawals.

8 Death before retirement

This chapter sets out our recommendation for the assumed rates of death before retirement, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

8.1 We recommend a single set of assumptions (separate for men and women) to allow for the possibility of death before retirement. Assumed rates of death before retirement increase with age but fewer than 0.5% of members are assumed to die each year, even at the highest ages. Sample rates are provided in Appendix A.

Previous valuation assumptions

8.2 The proposed 2016 assumptions are the same as those adopted for the previous valuation.

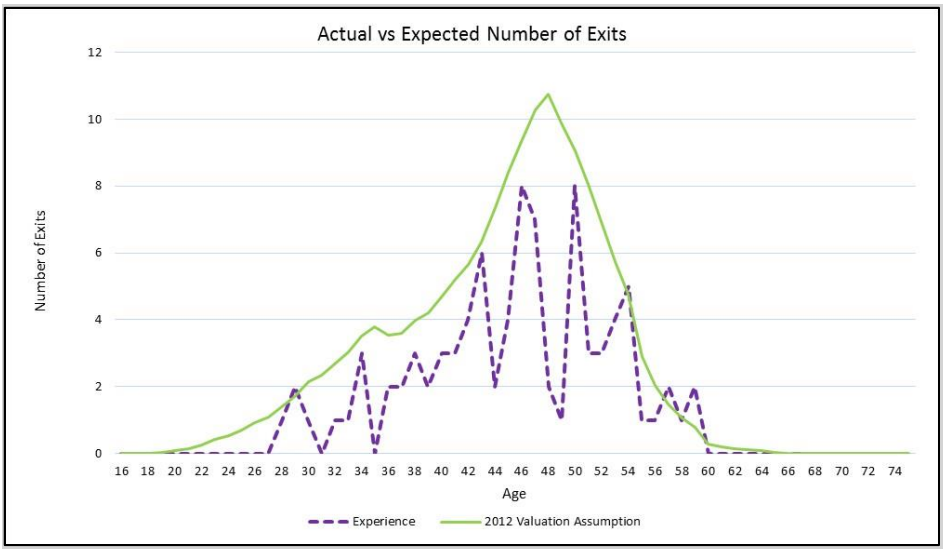
Use of the assumption

8.3 Death before retirement rates are used to allow for the possibility of deaths whilst in active service or whilst entitled to a deferred pension. The numbers of deaths observed annually, and the recommended rates to be assumed, are low, and thus this assumption has relatively little financial significance.

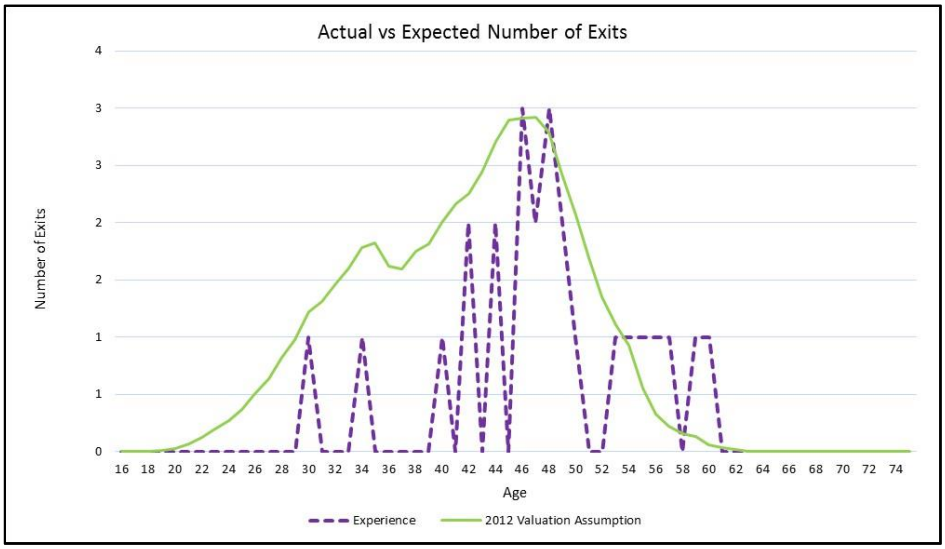
Analysis and setting the assumption

8.4 To formulate a recommended assumption we compared the scheme experience over 2012-2016 to the expected rates from the 2012 actuarial valuation. After excluding from the analysis 17 police forces (covering 24% of the membership) where the data did not appear to be reliable, Graphs 8.1 and 8.2 show the actual number of deaths compared to the number expected under the 2012 valuation assumption.

Graph 8.1: Male death before retirement experience 2012-16



Graph 8.2: Female death before retirement experience 2012-16



8.5 Graphs 8.1 and 8.2 show that the actual number of deaths over 2012-16 in the data provided were considerably lower than expected. Further analysis (in Table 8.1 below) shows that the actual number of deaths in the data is significantly lower than expected in the first three years of the analysis but is broadly in line with expectations in 2015-16.

Table 8.1: Deaths before retirement (male and female combined): Actual deaths vs deaths expected under the 2012 valuation assumptions

Year	Actual deaths*	Expected deaths (under 2012 valuation assumption)	Actual / Expected
2012-13	24	54	44%
2013-14	22	54	41%
2014-15	18	54	33%
2015-16	49	53	92%
Total	**113**	**216**	**52%**

*for the 28 police forces included in the analysis

8.6 Further checks were subsequently done on the data which identified the following issues:

- 14 police forces (covering 42% of members) did not provide data on any deaths in the period 2012-15 but did provide data on deaths in the period 2015-16. These forces provided data on 148 member movements in the period 2012-15 where the type of exit (e.g. death, withdrawal, ill health etc.) was left blank. We suspect that these should have been recorded as deaths but are not able to verify this with the information available.
- 7 police forces (covering 11% of members) did not provide data on any deaths over 2012-16.

8.7 Overall, there is significant uncertainty over the quality of the deaths data in the period 2012-15. The data for 2015-16 appears to be more reliable and shows that experience was broadly in line with the 2012 valuation assumption. Therefore, in the absence of any further evidence, we propose to maintain the existing assumption. We do not expect this assumption to be material to the result of the valuation.

9 Promotional pay increases

This chapter sets out our recommendation for the assumed promotional pay increases of active members, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumption

9.1 We recommend assuming a single combined scale of promotional increases for men and women. The increases are dependent on members' length of service and are steeper at lower service periods. Sample values from the scale are provided in Appendix A.

Previous assumption

9.2 The assumptions adopted for the 2012 valuation are the same as those recommended for the 2016 valuation.

Use of the assumption

9.3 For members of the 1987 and 2006 schemes, benefits earned in those schemes are linked to pay at or near retirement. Members' pay can increase through a combination of general annual pay awards and promotional increases. To calculate an estimate of the level of benefit payable in the future requires assumptions for both these components. The assumption for general pay awards is directed by HMT. The assumption for promotional pay increases is set by the Home Secretary.

9.4 Future pay progression will be more significant (in terms of expected pension) for those members with either full or tapered protection because they continue to accrue benefits linked to final pensionable pay for service beyond 31 March 2015.

Analysis and setting the assumption

9.5 There have been a number of recent events which may have affected the promotional pay increases observed over 2012 to 2016 and may also affect the promotional pay increases awarded in future. These events include:

- the Winsor review of police salaries
- the two year freeze on pay progression for police between 2012 and 2014
- the ongoing pay restraint in the public sector
- the gradual removal of competency related threshold payments (CRTP) between 2012 and 2016.

9.6 To formulate a recommended assumption we compared the scheme experience to the assumption adopted for the 2012 valuation. Two types of analysis were considered:

- A 'survivor analysis' which considers only those members who were in active membership at both the 2012 and 2016 valuation dates. For these members their increase in (WTE[30]) pensionable pay over the period (net of assumed general pay increases) is calculated. For the reasons discussed in paragraph 9.5, the period 2012 to 2016 is not expected to be a good indicator of future promotional pay increases and the survivor analysis is likely to be significantly distorted as a result. We have therefore decided not to perform this analysis.

- A 'profile analysis' considers the overall active membership as at 31 March 2016 and compares average (WTE[31]) pensionable pay at each length of service with that at other lengths of service. This analysis illustrates how average (WTE) pay varies by length of service. There may be some distortion to the 'profile analysis' for the reasons discussed in paragraph 9.5. However the effect is not expected to be as significant as with the survivor analysis. The results of the profile analysis are discussed below.

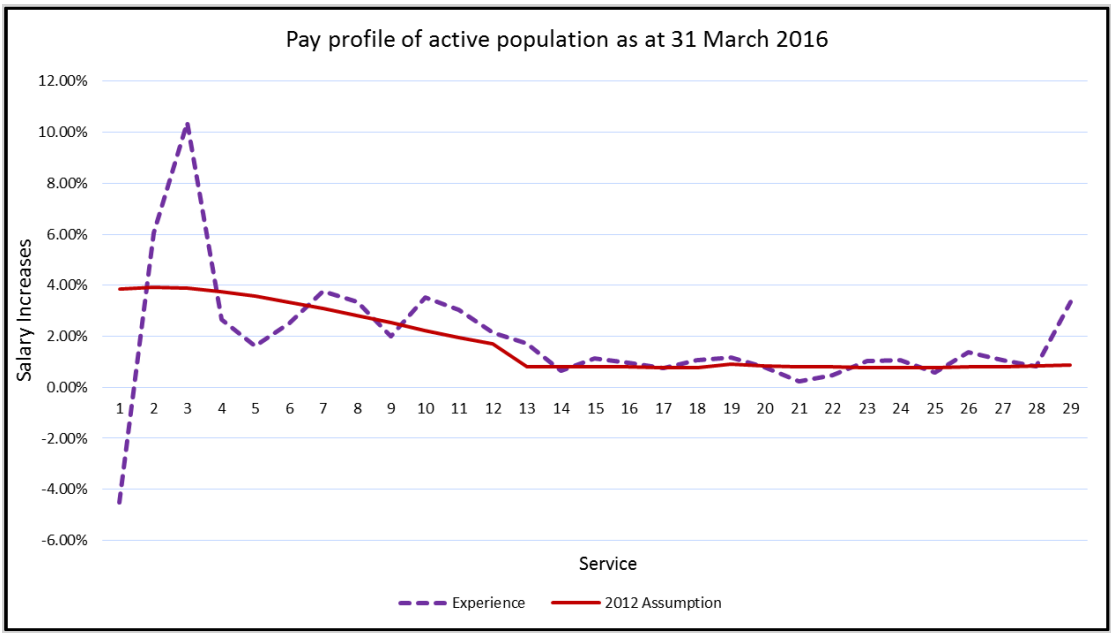
9.7 As discussed above, any analysis of recent experience is likely to be distorted to some extent. The profile analysis which has been completed suggests that the 2012 assumption remains appropriate. In the absence of any other evidence, we recommend that the 2012 assumption is maintained for the 2016 valuation.

Results of analysis

9.8 Graph 9.1 below shows the change in average pay at each service length based on the 'profile analysis' of all members at the valuation date (purple line). This is compared with the assumed increase from the service related promotional scale adopted for the 2012 valuation (red line).

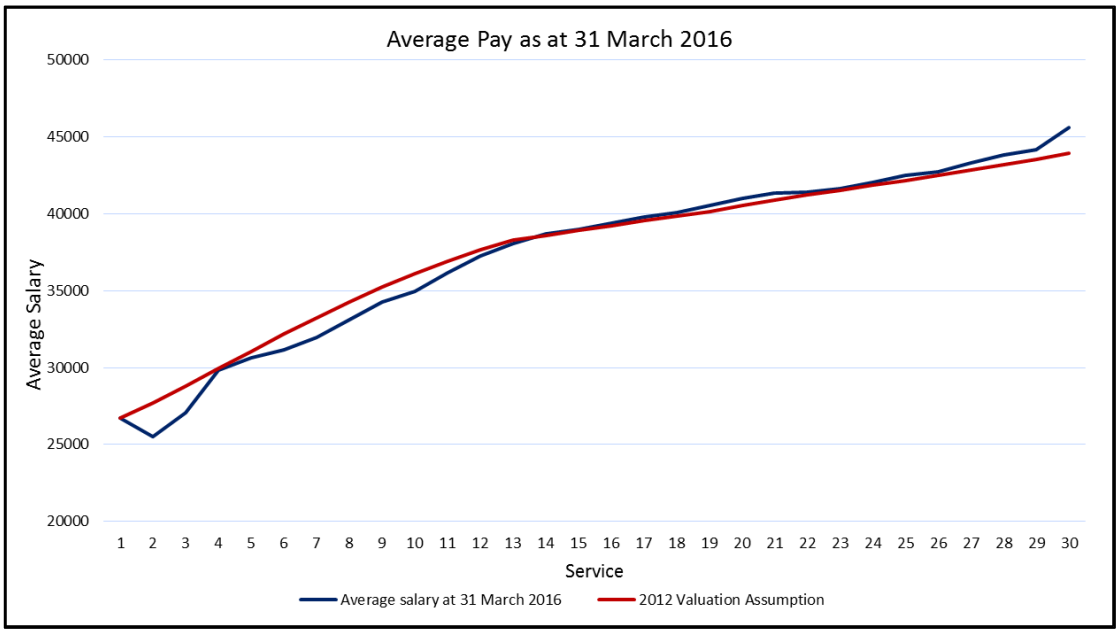
[30] Whole-time equivalent.
[31] Whole time equivalent.

Graph 9.1: Pay profile of active population as at 31 March 2016



9.9 Graph 9.2 compares the average pay of members as at 31 March 2016 for each service length against the assumed salary as 31 March 2016 for each service length using a starting salary from the 2015/16 pay scales and the 2012 promotional salary assumption.

Graph 9.2: Average pay at 31 March 2016 vs 2012 valuation assumption



Comments on the analysis

9.10 The results of the analysis show that experience has been broadly in line with the 2012 assumption.

9.11 There is some variation between experience and assumptions at the left hand side of Graph 9.1. However the assumptions at these lower lengths of service are less material to the valuation as those with short service will have small accrued pensions linked to their final salary. In addition, the majority of these people with short service will now be accruing benefits in the 2015 scheme, where the assumption about promotional pay increases is not as relevant.

9.12 There is also some variation between experience and assumptions at the far right hand side of Graph 9.1. We believe that this is due to anomalies in the data rather than due to members receiving larger pay rises at this point in their careers. Therefore it would not be appropriate to reflect this in our assumption.

10 Commutation of pension for cash at retirement

This chapter sets out our recommendation for the assumed level of pension commutation at retirement (where this is not specified in the HM Treasury valuation directions), and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

10.1 We recommend that members are assumed to commute the following proportions of their pensions for cash. The assumptions are the same for men and women.

Table 10.1: Recommended commutation assumption for the 2016 valuation

Member with service in the following schemes	1987/2006 Scheme only	Mixed 1987 and 2015 scheme		Mixed 2006 and 2015 scheme		2015 scheme only
Scheme pension commuted from	1987/2006	1987	2015	2006	2015	2015
All members	0%	0%	8.75%	0%	17.5%[32]	17.5%[33]

Previous valuation assumptions

10.2 The proposed assumptions have been updated since the previous valuation. At the 2012 valuation, no allowance for commutation of 2015 Scheme pension was made for unprotected members of the 1987 Scheme and the HMT directed assumption for 2006 and 2015 Scheme pension (for members without service in other schemes) was that 15% of pension would be commuted.

Use of the assumption

10.3 In the 1987 Scheme, members have the option to commute pension for a cash lump sum at retirement. In the 2006 Scheme, members receive an automatic lump sum but have the option to exchange some of this for higher annual pension payments. Under both schemes the terms under which these options are offered are actuarially equivalent to the benefits (and so the rate of commutation within these schemes is not expected to impact the cost of providing the schemes).

[32] Specified by HMT Directions.
[33] Specified by HMT Directions.

10.4 In the 2015 Scheme, members may commute part of their pension for a lump sum at a rate of £12 for each £1 of pension given up. In this scheme, the assumption about the amount of pension commuted is important because the value of the pension given up, as assessed using the actuarial assumptions underlying the valuation is, on average, more than £12 and so commutation has a significant impact on total liabilities and contribution rates.

10.5 Differences between assumed and actual commutation experience in the 2015 Scheme will feed through into the cost cap fund but commutation experience in the 1987 Scheme and rates of exchange of lump sum for pension in the 2006 Scheme will not.

Derivation of proposed assumptions

10.6 For the reasons set out in paragraph 10.3, for simplicity no allowance has been made for members commuting 1987 Scheme pension for cash or exchanging 2006 Scheme automatic lump sum for annual pension payments.

10.7 The assumption for commutation of 2015 Scheme pension by new entrants to that scheme and 2006 Scheme members who move across to the 2015 Scheme is directed by HMT.

10.8 The recommended assumption for members with mixed 1987 Scheme and 2015 Scheme service is based on reasonable assumptions about the behaviours of these members and data from any comparable experience, in the absence of any direct commutation experience for these members. 1987 Scheme members are not entitled to an automatic lump sum, but they are entitled to commute up to a quarter[34] of their pension on actuarially equivalent terms.

10.9 The terms available in the 1987 Scheme offer a significantly greater lump sum than would be available under the commutation terms of 12:1 offered in the 2015 Scheme. We would expect this to act as a substantial disincentive to commute pension in the 2015 Scheme, especially for those members with significant amounts of service in the 1987 Scheme (where the lump sum available from the 1987 Scheme is large). Even members with the least 1987 Scheme service are likely to be able to commute a lump sum from their 1987 Scheme benefits alone which is as large as the amount of lump sum assumed to be taken by new entrants into the 2015 Scheme. As such, we do not expect that former 1987 Scheme members will commute significant amounts of pension from the 2015 Scheme.

[34] In general but alternative limits apply to some members.

10.10 However, there is some evidence to suggest that a number of members of the 1987 commute pension above the HMRC tax limits. This tax charge can happen because members can commute 25% of pension (generally) and the commutation factors are higher than 20 at some ages. This suggests that members will commute additional pension when the effective terms (after tax) of that additional commutation are much less favourable than for the bulk of the pension they can commute. Therefore, this situation has similarities with the decisions which will be faced by the unprotected 1987 Scheme members, so can inform the proposed assumption.

10.11 We therefore propose that it is assumed that unprotected 1987 Scheme members will commute 8.75% of their 2015 Scheme pension, with this proportion being half of the proportion of 17.5% to be assumed for new entrants to the 2015 Scheme. We do not suggest that any averaging with the previous assumption is carried out in setting this assumption for the 2016 valuation, as the proposed assumption is based on new data that is now available, as opposed to a change in observed behaviours.

11 Family statistics

This chapter sets out our recommendation for the assumptions around dependants' pensions, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

11.1 We recommend the following assumptions.

Table 11.1: Recommended proportions married/partnered

	1987 Scheme		2006 and 2015 schemes	
	Proportion married[35]		Proportion partnered[36]	
	Males	**Females**	**Males**	**Females**
Current pensioners age 65 or above	100% ONS male proportion married rates	100% ONS female proportion married rates	100% ONS male proportion partnered rates	100% ONS female proportion partnered rates
Current pensioners below age 65	105% ONS male proportion married rates	105% ONS female proportion married rates	105% ONS male proportion partnered rates	105% ONS female proportion partnered rates
Future pensioners at retirement	80%	75%	85%	80%

- Male members are assumed to be three years older than their partners and female members are assumed to be three years younger than their partners.
- No allowance is made for remarriage on the grounds of materiality.
- All dependants are assumed to be the opposite sex to the member.

Previous valuation assumptions

11.2 All family statistic assumptions are the same as those adopted for the 2012 valuation.

[35] The assumptions are the proportion married at the valuation date, for current pensioners, or at retirement, for future pensioners.
[36] The assumptions are the proportion partnered at the valuation date, for current pensioners, or at retirement, for future pensioners.

Use of the assumptions

11.3 Dependants' pensions[37] are provided to qualifying dependants on the death of a member. In the 1987 Scheme, dependants' pensions are payable to legal spouses and civil partners only. In the 2006 and 2015 schemes, dependants' pensions are payable to qualifying partners as well as to legal spouses and civil partners. Assumptions are required for the proportion of members who are married or partnered to determine how many dependants' pensions will be paid. Assumptions are required about age differences between members and their spouses/partners as this affects how long dependants' pensions will be paid for.

11.4 In the 1987 Scheme, a surviving dependant's pension ceases upon remarriage[38]. In the 2006 and 2015 schemes, this is not the case and benefits continue to be paid following remarriage.

Analysis and approach to setting the assumptions

11.5 To formulate a recommended assumption we compared the scheme experience with the corresponding 2012 assumption. 14 out of 45 forces (covering 38% of members) had provided sufficient data to analyse. We analysed the proportion of male pensioner deaths giving rise to the payment of a surviving spouse's or partner's pension. The vast majority of deaths observed relate to 1987 Scheme members and so would qualify for a pension to a legal spouse or civil partner. The analysis therefore compared the aggregate experience with the 2012 assumption for male proportions married (rather than partnered), which was based on the male population proportion married statistics which are published by the Office for National Statistics (ONS).

11.6 There is too little experience for female 1987 Scheme pensioners to carry out a credible analysis. We have no reason to believe that the experience for 1987 Scheme females (relative to the ONS's female proportion married tables) would differ from that seen for 1987 Scheme males. Therefore, we recommend applying the same adjustment to the relevant ONS table as for 1987 Scheme males.

11.7 For current 2006 and 2015 scheme pensioners, there is too little experience to carry out a credible analysis. We have no reason to believe that the experience for 2006 and 2015 scheme pensioners (relative to the ONS proportion partnered tables) would differ from that seen for 1987 Scheme males (relative to the ONS's male proportion married tables). For these members, for whom the definition of a qualifying dependant is broader, we recommend applying the same adjustment to the relevant ONS tables as for 1987 Scheme males.

[37] Pensions are also payable to dependent children on a member's death but the costs are not material overall and we therefore do not intend to make any allowance for them in the valuation.
[38] Except in certain circumstances.

11.8 For future pensioners, the proportion married/partnered at retirement will be used in our calculations, rather than the proportion married/partnered at the valuation date. We recommend that the assumptions for proportions married/partnered at retirement for future pensioners are the same as the proportions married/partnered at the valuation date for current younger pensioners. For example, about 80% of current male pensioners at all ages below 65 are assumed to be married at the valuation date. For consistency, 80% of future male pensioners will be assumed to be married when they reach retirement.

Results of analysis: Proportions dying with dependant pension payable compared to 2012 assumption of proportion married

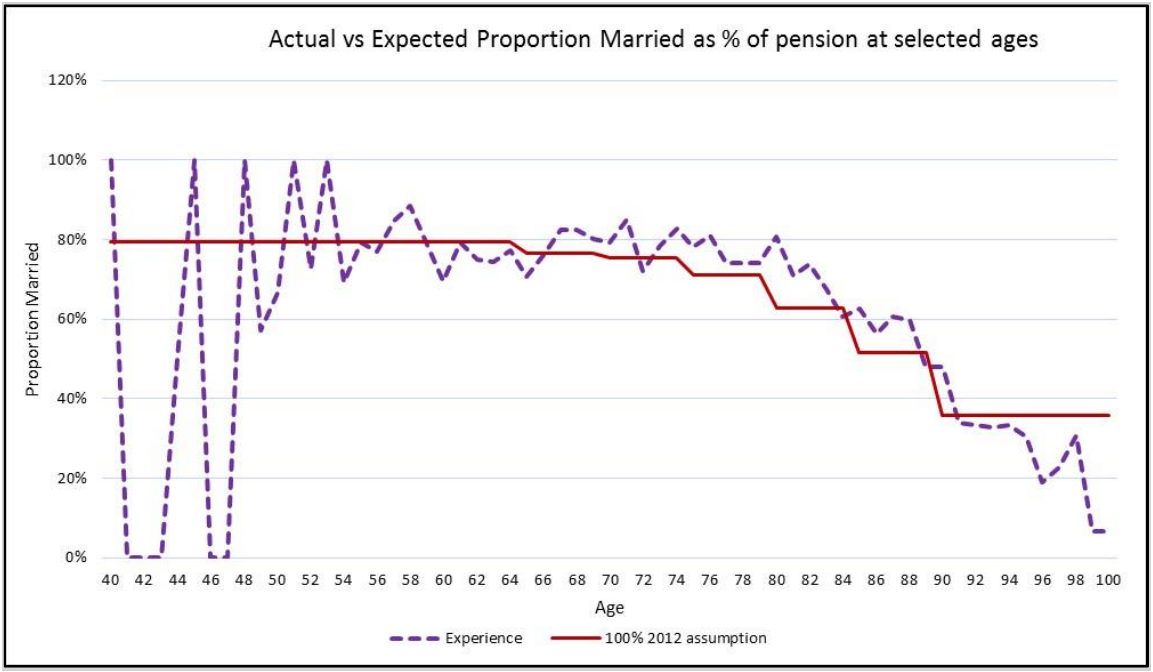
11.9 The overall ratio of actual to expected numbers of male members dying over the four-year period to 31 March 2016 and leaving a dependant eligible for a contingent pension are shown in the table below. In the below, expected numbers are based on the proportions married assumptions adopted for the 2012 valuation for the reasons outlined above.

Table 11.2: Comparison of actual to expected proportions married at death

	Actual / Expected
Males	106%

11.10 The graph below shows a similar comparison but split by age at death.

Graph 11.1: Male pensioners: Actual proportions married against expected based on 2012 valuation assumptions



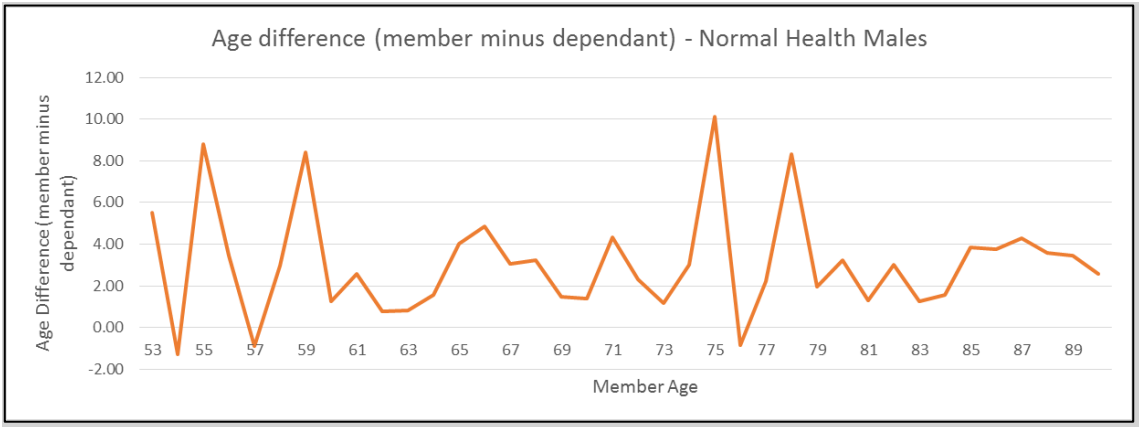
11.11 Table 11.2 and Graph 11.1 show that proportions married have been very slightly higher than assumed in the 2012 valuation. Given the small difference between experience and the 2012 assumption and the fact that we were only able to analyse 38% of the recent experience, our recommendation is that the 2012 assumption for male proportions married is retained for the 2016 valuation.

Results of analysis: Age difference between member and dependant

11.12 562 members had dependants' dates of birth sufficient to be used in the analysis. We excluded data from police forces where dates of birth were missing or looked incorrect (eg where the dependant's date of birth was the same for many of the members).

11.13 Graph 11.2 below shows the results of the analysis for normal health male pensioners, who made up 80% of the members analysed.

Graph 11.2: Age difference (member age minus dependant age) for Normal Health males



11.14 Graph 11.2 above shows that the limited available evidence suggests that male members are typically between two and four years older than their dependants on average. We therefore recommend that the 2012 assumption (that male members are three years older than their dependant) is retained for the 2016 valuation.

11.15 There is not sufficient data available to analyse the age difference for female members. We recommend that the 2012 assumption (that female members are three years younger than their dependants) is retained for the 2016 valuation.

Appendix A: Details of assumptions

This appendix contains details of the recommended assumptions including sample rates and values.

Pensioner mortality

Table A1: Baseline mortality assumptions

Baseline mortality	Standard table[39]	Adjustment
Males		
Retirements in normal health	S2NMA	104%
Current ill-health pensioners	S2NMA	142%
Future ill-health pensioners	S2IMA	100%
Dependants	S2NMA	103%
Females		
Retirements in normal health	S2NFA	104%
Current ill-health pensioners	S2NFA	142%
Future ill-health pensioners	S2IFA	100%
Dependants	S2NFA	103%

As specified by HM Treasury, future improvements in mortality will be assumed to be in line with those underlying the ONS-2016 population projections.

[39] From the 'S2' series of standard tables published by the CMI and based on the experience of self-administered pension schemes. Separate tables are available based on experience of members retiring in normal and ill-health and for dependants.

Age retirement from service

Table A2: Age retirement rates for 1987 Scheme members with full and tapered protection

Retirement Age	Entry Age		
	20	25	30+
48	-	-	-
49	-	-	-
50	0.800	0.030	-
51	0.550	0.015	-
52	0.400	0.015	-
53	0.400	0.015	-
54	0.400	0.015	-
55	0.400	0.900	0.200
56	0.400	0.550	0.200
57	0.400	0.400	0.200
58	0.400	0.400	0.200
59	0.400	0.400	0.200
60	1.000	1.000	1.000

Table A3: Age retirement rates for 1987 Scheme members with no protection

Retirement Age	Entry Age		
	20	25	30+
55	0.970	0.900	0.225
56	0.400	0.550	0.100
57	0.400	0.400	0.100
58	0.400	0.400	0.100
59	0.400	0.400	0.100
60	1.000	1.000	1.000

Table A4: Age retirement rates for 2006 Scheme members

Retirement Age	All Entry Ages
55	0.292
56	0.033
57	0.033
58	0.033
59	0.033
60	1.000

Table A5: Age retirement rates for new entrants to the 2015 scheme

Retirement Age	All Entry Ages
55	0.250
56	-
57	-
58	-
59	-
60	1.000

Ill-health retirement from service

Table A6: Ill-health retirement rates for all members

Age	Males	Females
20	0.0000	0.0000
25	0.0000	0.0004
30	0.0001	0.0013
35	0.0009	0.0023
40	0.0016	0.0049
45	0.0051	0.0101
50	0.0093	0.0152
55*	0.0136	0.0203
59*	0.0169	0.0245

*rates are zero if above the retirement age of the relevant scheme

Voluntary withdrawal from service

Table A7: Withdrawal rates for all members

Age	Males	Females
20	0.0253	0.0253
25	0.0165	0.0165
30	0.0125	0.0127
35	0.0117	0.0122
40	0.0102	0.0113
45	0.0067	0.0089
50*	0.0050	0.0064
55*	0.0000	0.0000

*rates are zero if eligible to retire

Death before retirement

Table A8: Death before retirement rates for all members

Age	Males	Females
20	0.0002	0.0001
25	0.0002	0.0001
30	0.0003	0.0002
35	0.0004	0.0003
40	0.0005	0.0005
45	0.0007	0.0007
50	0.0010	0.0012
55	0.0017	0.0018
60	0.0025	0.0028
65	0.0040	0.0043

Promotional pay increases

Table A9: Promotional salary scales for all members

The salary scale shows assumed pay progression in excess of general wage inflation in comparison to an index base of 100 at entry.

Service	All members
0	100
5	121
10	141
15	152
20	158
25	164
30	171
35	171
40	171

Commutation of pension for cash at retirement

Table A10: Recommended commutation assumptions for the 2012 valuation

Members are assumed to commute the following proportions of their pensions for cash

Member with service in the following schemes	1987/2006 Scheme only	Mixed 1987 and 2015 scheme		Mixed 2006 and 2015 scheme		2015 scheme only
Scheme pension commuted from	**1987/2006**	**1987**	**2015**	**2006**	**2015**	**2015**
All members	0%	8.75%	0%	0%	17.5%	17.5%

Family statistics

Table A11: Recommended proportion married or partnered at retirement for future pensioners

	1987 Scheme	2006 Scheme and 2015 Scheme
	Proportion married	Proportion married or partnered
Males	80%	85%
Females	75%	80%

Table A12: Recommended proportion married or partnered for current pensioners (at the valuation date)

	1987 Scheme		2006 Scheme and 2015 Scheme	
	Proportion married		Proportion married or partnered	
Age	**Males**	**Females**	**Males**	**Females**
50	80%	75%	85%	80%
60	80%	74%	85%	77%
70	75%	56%	78%	57%
80	63%	28%	64%	28%
90	36%	8%	36%	8%

Males are assumed to be three years older than their female partners.

Appendix B: Modelling approach and minor assumptions

Active membership projections

B.1 Direction 11[40] requires the actuary to use the 'projected unit methodology' to calculate the valuation results. The valuation results require the calculation of the cost of benefit accrual over periods after the effective date (31 March 2016). The expected cost of benefits provided to members remaining in the 1987 and 2006 schemes under the provisions of transitional protection differs from the expected cost of providing members with benefits in the 2015 scheme. Further, the expected cost of providing benefits varies for members in the 1987 and 2006 schemes. This implicitly requires the actuary to estimate the membership at future dates in order to determine the valuation results.

B.2 Since the majority of members (around 62%) were accruing benefits in the 2015 scheme at the effective date, and further, given that the remaining members continuing to accrue benefits in the pre-2015 scheme are expected to rapidly decline to close to nil over the future periods being considered in this valuation, a pragmatic approach to estimating the future membership of each section/scheme over the relevant future periods is suitable.

B.3 The expected cost of accruing benefits over periods after effective date have been determined by assuming an overall stable population (age and pay profile) to end of implementation period. In particular:

- Allow for the protected population to reduce over the projection period (ie to 2023) with a corresponding increase in those accruing benefits in the 2015 Scheme to maintain the stable population. SPA in the projected populations is determined by implied dates of birth and so the SPA mix changes over time despite the assumed stable population.
- Mortality is projected forward to the relevant year of use in all cases.
- The run off of the protected population is broadly linear from the relevant calculation date to the average age at which members of each identified group (eg 1987 Scheme, 2006 Scheme) are expected to retire.

B.4 The expected cost of accruing benefits over periods after the effective date for cost cap purposes has been determined by assuming:

- The aggregate membership has the same age/pay profile over all projection periods (i.e. to 2023) (and assuming all in the 2015 Scheme).

[40] The Public Service Pensions (Valuations and Employer Cost Cap) Directions 2014 as amended by the (Amendment) Directions 2018 ("the Directions").

- Allow for the actual membership (assumed) accruing benefits in the 2015 Scheme to change over the projection period (i.e. to 2023). SPA in the projected populations is determined by implied dates of birth and so the SPA mix changes over time despite the assumed stable population.

- Mortality is projected forward to the relevant year of use in all cases.

Grouping of individual active member records

B.5 Individual active members have been grouped together for the purposes of calculating liabilities. This grouping is necessary to accommodate the volume of data within our valuation system. The approach taken to grouping the data has been tested to ensure it does not result in any distortion of the valuation results. The groupings are made for protection status (ie protected, tapered or unprotected), section/scheme (ie 1987, 2006, 2015 scheme), sex, age, State Pension age and service.

Accrual cost methodology

B.6 When determining the costs of accrual as required by Directions 27(1)(d) and 40(1) the cost for members in each group at each relevant date (as identified from the membership projections) has been determined for each age and that rate has been applied to the total pensionable pay at each age to determine the average for the membership as a whole at each date. The cost over each relevant period has been taken as the average of the cost at the start and end of each period. The calculation allows for mortality improvements assuming the calculation date is the midpoint of each period.

B.7 Direction 11 requires use of the projected unit methodology to determine the valuation results. Directions 14, 16 and 17 specify some modifications to the financial assumptions in the short term. An implication of the short term modifications is that the projected unit methodology is expected to result in an increasing standard contribution rate over successive periods. For example the cost of accrual over the period 2015 - 2019 is lower than that over the period 2019 - 2023 (ignoring any redistribution of members into the 2015 Scheme). This effect is not material for final salary benefits and has no effect on the employer cost cap future service cost calculation since short term assumptions are explicitly disregarded for this purpose in Direction 40.

B.8 Non-accruing benefits such as lump sums payable on death in service have been recognised only when a benefit payment is expected.

B.9 Members accruing or expecting to accrue benefits at double rate (in the 1987 Scheme) are treated as though the overall expected benefit accrues uniformly over all service.

Guaranteed Minimum Pensions (GMPs)

B.10 A global adjustment was applied to reduce the past service liability in respect of estimated GMP entitlements. The reduction is equivalent to a reduction in the contribution rate of around 1.1% of pensionable pay over the 15 year period from the implementation date. This estimation has no impact on the calculation of the cost cap.

Earnings cap

B.11 The earnings cap only applies in limited circumstances in the 1987 Scheme. No allowance has been made for its impact as this would not be material to the valuation results. There is no earnings cap in the 2006 and 2015 schemes.

Public Service Transfer Club (PSTC)

B.12 Allowance has been made for the potential additional liabilities arising from inward transfers on PSTC terms (because the transfer value is usually less than the cost of providing the service credit granted). If volumes of transfers continue at historic levels the financial impact is expected to be equivalent to an employer contribution cost of 0.3% of pay.

General pay increases

B.13 Direction 17 sets out the general pay increases that are to be assumed for valuation purposes.

Final pensionable pay

B.14 All liabilities have been based on pensionable pay at the effective date as provided by administrators. No explicit allowance has been made for the impact of prior years' earnings resulting in higher final pensionable pay for particular members since this effect is not expected to impact a material number of members.

Dependants' pensions

B.15 No allowance has been taken for short term dependant pensions or children's pensions (other than those already in payment), on ground of immateriality.

Expenses

B.16 No allowance has been made for expenses. Expenses are outside the valuation framework.

Early retirement factors

B.17 When modelling retirement from the 2015 Scheme before Normal Pension Age where an actuarial reduction would be applied early retirement factors have been set equal to those which would apply using the long term assumptions under the Directions (applied for the appropriate period before the normal pension age). In the 2015 Scheme, the actuarial reduction is set to give the early retirement pension the same value as deferred benefits payable following withdrawal at the same age (but with reference to payment age 60 rather than the usual deferred payment age of SPA).

B.18 There is no option to retire from active service with actuarially reduced benefits in the 1987 or 2006 schemes.

Added Years

B.19 In certain limited circumstances officers can purchase additional service. The added years data supplied to GAD could not be easily associated with the main pension data for officers who had purchased this option. Further, from the 2012 valuation, added years were deemed not to have a significant impact on the valuation results. As such, a pragmatic approach has been used to model added years in which an adjustment has been applied to increase the overall active members' liability to allow for added years which represents around 0.1% of past service liability.

Member contribution yield over implementation period

B.20 The average member contribution yield expected over the implementation period is estimated to be 13.5% of pensionable pay. This calculation uses the employee contribution rates for each scheme, as set out in scheme regulations. This compares to an average member contribution yield of 13.7% of pensionable pay that was expected over the period from April 2015 to March 2019.

Other Direction interpretations

Directions 27 and 28 (contribution rates)

B.21 27(1)(a) and 27(1)(c): For the purposes of spreading any past service surplus or deficit, the future payroll estimates provided by the Home Office to OBR (September 2017 return) have been used for the period up to 2019/20 (with the figures adjusted in the years 2020/21 and 2023/24 to convert from OBR pay growth assumptions to valuation assumptions). After 2023/24, payroll has been projected assuming a stable workforce size and using valuation assumptions.

B.22 27(1)(c)(ii) and 28: Member contributions since the effective date based on actual (or expected) yield for past periods and periods up to 31 March 2019. Set equal to the expected contribution yield from April 2019 based on current member contribution rates set out in the scheme regulations. See B.20.

B.23 27(1)(b) and 27(1)(d): see B.3 and B.4.

Directions 28, 31, 32(1), 33(2)(a) (and related) – member contribution yields

B.24 See paragraph B.22.

Direction 32(1) – expected cost of benefits for past periods (for cost cap purposes)

B.25 The contribution rate required to cover cost of benefits over 2015-16 is calculated by considering the membership over the period 2015-16.

Directions 32(1) and 40(1) – expected cost of benefits for future periods (for cost cap purposes)

B.26 See B.4.

Direction 34 – benefits paid from 2015 Scheme during 2015-2016

B.27 Estimated where data unavailable.

Appendix C: Assumptions made for data uncertainties

Summary

C.1 Whilst comprehensive data was received either directly by the individual police forces or via their appointed administrators for the 2016 valuation, some aspects of the data were incomplete and/or unreliable for certain elements of our valuation calculations.

C.2 It has not been possible to fully resolve these data issues in the timescale required for the valuation. Therefore to calculate results for the 2016 valuation of the Scheme, assumptions are required in respect of incomplete and/or unreliable individual member records and movements data. The latter is used for setting assumptions and in the calculation of the cost cap net leavers liability.

C.3 Scheme specific assumptions are determined by the "responsible authority", which is the Home Office in the case of the Scheme, and must be set as best estimate assumptions and not include margins for prudence or optimism.

Individual member records

C.4 Membership data is provided either directly by the individual police forces or via their appointed administrators for the purpose of the 2016 valuation and we apply checks to these membership records to ensure all key data items are provided and reliable for valuation purposes. Following these checks, it was identified that individual member records at the relevant dates as required for valuation purposes were not fully complete and reliable. We worked with force and administrators to address a number of these issues. However, where critical data items were missing from member records, the general approach taken was to exclude that record for calculation purposes with calculations based on the remaining dataset being rated up incorporate an allowance for the excluded records.

C.5 Uprating factors were determined for each membership category equal to the ratio of known valid records and the number of records with adequate data. Implicitly this uprating approach assumes that the records with omissions or errors have the same average profile (age, sex, pay, service) as fully complete records. Some 1.3% of records were excluded from the 2016 valuation data and around 0.2% of the data provided for the purposes of setting the initial cost cap fund.

C.6 As noted, the approach taken to data omissions is to assume each record with missing data has the same average profile as the complete records and therefore there is a risk that this assumption is not appropriate. The table below indicates the extent to which the valuation results might be incorrect if the approach in fact under/overstates the liability for the omitted members by 10%, which we believe to be a reasonable level to consider.

	Impact of error in assumption for missing data (as % of pay)	
	Uncorrected employer contribution rate	Employer contribution correction cost
Actives (uprating applied: 1.027 for 2016 data, 1.002 for 2015 data)	0.1%	0.1%
Deferreds (uprating applied: 1.008)	not material	nil
Pensioners (uprating applied: 1.004)	not material	nil

C.7 The table above illustrates the potential impact if known data omissions are subsequently found to have been handled incorrectly. Since it is not possible to undertake independent checks for all categories of members and a full reconciliation has not been achieved against all prior datasets there is the potential for currently unidentified problems with the data to emerge in future. For example, a group of deferred members could be identified where no liability has previously been determined. The impact of such unknowns emerging at subsequent valuations could be considerably more than the sensitivity indicated above.

Movements data

Setting assumptions

C.8 Each police forces or their appointed administrators supplied data on the experience of the Scheme's membership over the four-year period to 31 March 2016. Fully complete and comprehensive data about members moving status between certain dates (eg leaving active status due to death or retirement) was not able to be provided. Analysis of member movements is needed to inform scheme specific demographic assumptions as scheme-specific experience, both recent and longer term, generally provides the most reliable evidence when considering best estimates of future experience.

C.9 Assumption setting relies on analysis of movements data in consideration with such other relevant information which is available. The setting of demographic assumptions is to some extent subjective and a matter of interpretation. Changes in assumptions may be expected at successive valuations as circumstances change even with full data. Thus the absence of fully complete movements data does not necessarily introduce uncertainty into the valuation results provided there is other relevant information available to inform those assumptions. It is to be expected that there is some volatility in the experience arising from an analysis of movements data. As assumptions are intended to reflect long term expectations it is reasonable to seek to smooth out the impact of these short term effects. A number of the recommendations we make for scheme-specific valuation assumptions smooth out the short term effects by taking only a proportion of the difference in experience since the 2012 valuation, for example in recommending the assumption for baseline pensioner mortality.

C.10 It should however be recognised that should movements data become available for future valuations it could result in recommendations regarding appropriate assumptions which lead to greater changes in valuation results than otherwise. It is difficult to quantify the potential scale of this discontinuity but it could be over +/-1% of pensionable pay on the uncorrected employer contribution rate. For example, if the number of pensioner deaths was overstated or understated in the data available for setting assumptions for the 2016 valuation but correctly stated at a subsequent valuation, this would have an impact on the mortality assumptions adopted and potentially lead to a large change in the assumption at future valuations and hence a corresponding change in liability and employer cost.

Cost cap net leavers liability (CCNLL)

C.11 The initial cost cap fund is set equal to the liability for actives members at 31 March 2015. The cost cap mechanism is intended to manage the costs of the reformed scheme and recognise any unexpected experience relating to pre-reformed entitlements of members in service at 1 April 2015, but only to the point at which they leave active service. CCNLL is a quantification of the amount of pre-reformed liabilities which fall out of the cost cap fund at a valuation owing to members which have left service since the previous valuation (or since the initial cost cap fund was set in the case of the 2016 valuation), net of the additional liabilities in respect of members with pre-reformed service who rejoined active membership during 2015-16.

C.12 To accurately calculate CCNLL in accordance with the directions requires full movement data for all members who were active in 2015 and are no longer active at the 2016 valuation. The data available was not suitable for calculating the CCNLL and it was not possible to make assumptions to adjust the data available to provide for a reasonable estimate of CCNLL to be calculated. As the data available was not fully suitable for calculating the CCNLL, some adjustments were required to provide for a reasonable estimate of the CCNLL to be calculated.

C.13 We expect that the uncertainty introduced by the approach above is not more than ¼% of pay.

C.14 We would not expect significant unidentified experience gains or losses to arise over the one year period 2015 to 2016, although some uncertainty remains. In addition, we have reconciled the surplus or deficit arising over the period 2012-16 with a small unattributed item.

C.15 For the 2016 valuation, the CCNLL calculation period is only one year, rather than a full four-year valuation. Given the short period over which any gain or loss may have arisen it might reasonably be concluded that the lack of data for the CCNLL calculation is not critical for this valuation although it would become so in future valuations when a longer period is considered.

Appendix D: Sensitivity of valuation results to assumptions set by the Home Secretary

D.1 The table below provides an indication of the sensitivity of the valuation results to the particular assumptions under consideration. The figures shown here are also provided in section 4 of the formal valuation report.

Table D1: Sensitivity of valuation results to assumptions set by the Home Secretary

	Addition to uncorrected employer contribution rate	Addition to employer contribution correction cost
Membership profile: 2 years older on average over implementation period	1.0%	1.0%
Mortality rates: 5%* heavier rates of pensioner mortality	(1.6)%	(0.7)%
Age retirement rates: All members without full or tapered protection to retire at 55	(0.3)%	(0.8)%
Commutation (other than as directed): all unprotected members of the 1987 Scheme section commute 17.5% of 2015 Scheme pension	(0.8)%	(0.4)%
Ill-health retirement: 5%* increase to assumed rates	0.1%	0.1%
Ill-health retirement: 5%* increase in proportion assumed to receive higher tier benefits	0.0%	0.0%
Proportions partnered: 5%* more members assumed to have qualifying partners at death	0.8%	0.3%
Resignations and opt outs: 5%* higher numbers assumed to leave voluntarily before retirement (net of rejoiners)	(0.1)%	(0.1)%
Promotional pay increases: 0.5% higher promotional pay increases than assumed	2.9%	2.5%

* All these represent multiplicative increases to rates, i.e. 5% means rates 1.05 times higher.

Note: Opposite changes in the assumptions will produce approximately equal and opposite changes in the valuation results.

D.2 In each variant of Table D1 the sensitivity shown is in relation only to the change in the assumption described. The impact of a combination of assumption changes will not necessarily equate to the sum of the relevant rows above.